PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-027899
(43)Date of publication of application : 04.02.1994

(51)Int.Cl. G09G 3/36

(21)Application number : 04-307323
(22)Date of filing : 17.11.1992

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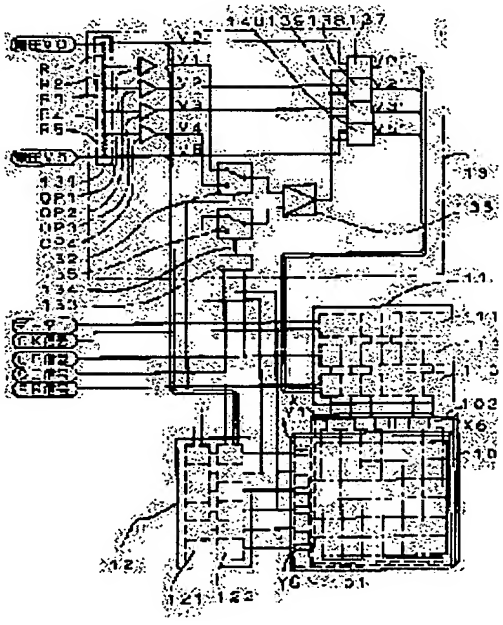
(30)Priority

Priority number	Priority date	Priority country
04122144	14.05.1992	JP
04122145	14.05.1992	JP

(54) LIQUID CRYSTAL DISPLAY DEVICE AND ELECTRONIC EQUIPMENT

(57)Abstract:



PURPOSE: To reduce the generation of display unevenness with simple circuit constitution by detecting the voltage variation or current variation at a certain part of a liquid crystal display device system and assuming distortion generated on an electrode of a liquid crystal panel, and adding a correcting voltage, generated on the basis of the distortion, to a driving voltage waveform.

CONSTITUTION: An input voltage switching control circuit 133 outputs the voltage that a Y driver 12 outputs to a scanning electrode Y5 in a period wherein a selection voltage is applied from a scanning electrode Y1 to Y3, the voltage that the Y driver 12 to a scanning electrode Y2 in a period wherein the selection voltage is applied from Y4 to Y6 to a differential amplifier circuit 136 respectively. Then the differential amplifier circuit 136 outputs only the distortion of the voltage waveform that the Y driver 12 outputs to the scanning electrode Y2 or Y5. This distortion is added by voltage adding circuits 137-140 to voltages V0-V4 to obtain voltages V0'-V4', which are outputted to an X driver 11. Namely, voltage variations on the scanning electrodes Y1-Y6 are detected and the voltages on signal electrodes X1-X6 are also varied corresponding to them.

LEGAL STATUS

[Date of request for examination]	16.09.1999
[Date of sending the examiner's decision of rejection]	05.03.2002
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection] 2002-05832

[Date of requesting appeal against examiner's decision of rejection] 04.04.2002

[Date of extinction of right]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The liquid crystal panel with which it is formed so that two or more scan electrodes may be formed in one substrate of the substrate of the pair which pinches a liquid crystal layer and two or more signal electrodes may intersect said scan electrode at the substrate of another side, and the amount of this intersection becomes a display dot, The scan electrode drive circuit which supplies a driver voltage wave to said two or more scan electrodes of each of this liquid crystal panel, The signal-electrode drive circuit which supplies a driver voltage wave to said two or more signal electrodes of each, The power circuit which generates two or more electrical potential differences which need two or more electrical potential differences and said signal-electrode drive circuits which need said scan electrode drive circuit to form the driver voltage wave supplied to said two or more scan electrodes of each to form the driver voltage wave supplied to said two or more signal electrodes of each, In the liquid crystal display possessing the amendment means which adds the correction voltage according to the alphabetic character and graphic form which said liquid crystal panel displays to at least said driver voltage [to which it is impressed by said scan electrode] wave-like, and said driver voltage wave-like one side which are impressed to said signal electrode The electrical potential difference which said amendment means generates in a part of said liquid crystal panel, said scan electrode drive circuit, said signal-electrode drive circuit, or power circuit [at least], Or the liquid crystal display characterized by making into said correction voltage said electrical potential difference which possesses a detection means to detect change of a current and this detection means detects, or the electrical potential difference of the magnitude according to change of a current.
[Claim 2] The liquid crystal display characterized by detecting electrical-potential-difference change of a difference with at least one electrical potential difference in a liquid crystal display according to claim 1 among the electrical potential differences which said detection means needs for forming the driver voltage wave of at least 1 scan electrode, and the driver voltage wave which said scan electrode drive circuit which said power circuit generates supplies to said two or more scan electrodes of each among said two or more scan electrodes of each of said liquid crystal panel.
[Claim 3] It forms so that the substrate with which said scan electrode of said liquid crystal panel is formed may be intersected in a liquid crystal display according to claim 1 with said some of two or more signal electrodes [at least] in at least one or more electrical-potential-difference detection electrodes. Or the liquid crystal display with which it forms so that the substrate with which said signal electrode of said liquid crystal panel is formed may be intersected with said some of two or more scan electrodes [at least] in at least one or more electrical-potential-difference detection electrodes, and said detection means is characterized by detecting the voltage variation generated in said electrical-potential-difference detection electrode.
[Claim 4] The liquid crystal display characterized by detecting the current to which said detection means flows in said scan electrode drive circuit from said power circuit in a liquid crystal display according to claim 1 about at least one electrical potential difference which said power circuit supplies to said scan electrode drive circuit.

[Claim 5] The liquid crystal display characterized by setting up the predetermined function with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables, and generating the correction voltage according to this function when change of the electrical potential difference or current which said detection means detects is plurality in a liquid crystal display claim 2, 3, or given in four.
[Claim 6] The liquid crystal display characterized by being the function with which said function equalizes said two or more variables in a liquid crystal display according to claim 5.
[Claim 7] When said electrical-potential-difference detection electrode formed in said liquid crystal panel is plurality in a liquid crystal display according to claim 3 Two or more correction voltage which set up the predetermined function with which said amendment means makes change of the electrical potential difference which said detection means detects from said each electrical-potential-difference detection electrode two or more variables, and responded to this function is generated, The liquid crystal display characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.
[Claim 8] The liquid crystal display with which said electrical-potential-difference detection electrode is characterized by having changed the area of the part which this electrical-potential-difference detection electrode, said two or more signal electrodes, or said scan electrode intersects respectively with said signal electrode or said scan electrode in a liquid crystal display according to claim 3.
[Claim 9] Two or more correction voltage which set up two or more predetermined functions with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables in a liquid crystal display according to claim 5, and responded to these two or more functions is generated, The liquid crystal display characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.
[Claim 10] The liquid crystal display characterized by generating the correction voltage according to the number of dots to which said amendment means is [of said display dots of electrical-potential-difference change which said detection means detects, and said liquid crystal panel] on in a liquid crystal display according to claim 3.
[Claim 11] Electronic equipment characterized by providing a liquid crystal display claim 1, 2, 3, 4, 5, 6, 7, 8, 9, or given in ten.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to an improvement of display unevenness in detail about a liquid crystal display.
[0002]
[Description of the Prior Art] A drive and a display are performed because the liquid crystal panel of a liquid crystal display supplies the voltage waveform (it is henceforth called a driver voltage wave.) which consisted of different electrical potential differences generated in the scan electrode and signal electrode which constitute a liquid crystal panel in the power circuit in a liquid crystal display. And these driver voltage waves change according to the contents which a liquid crystal panel displays.
[0003] Here, distortion arose in the voltage waveform impressed to a scan electrode and a signal electrode by the voltage waveform which a liquid crystal panel is a capacitive load, and is impressed to a scan electrode and a signal electrode since the scan electrode and the signal electrode have electric resistance, and there was a problem said that unevenness occurs in a display by this.
[0004] The approach of adding correction voltage to a driver voltage wave which was shown by JP,2-89,A for which the writer etc. applied, and correcting distortion about this problem, was learned.
[0005]
[Problem(s) to be Solved by the Invention] However, since the approach shown by JP,2-89,A etc. needed the circuit for calculating the amount of amendments beforehand when performing this although it could reduce display unevenness remarkably, the liquid crystal display became complicated and small lightweight-ization was difficult.
[0006] This invention is made in view of this problem, and it notes that distortion produced in the voltage waveform impressed to a scan electrode and a signal electrode is specified by total of change of the electrical potential difference on the signal electrode to the electrical potential difference on a scan electrode. Since the current according to total of change of this electrical potential difference furthermore flows to a power circuit, distortion generated in the scan electrode or signal electrode within a liquid crystal panel by supervising change of these electrical potential differences or change of a current is presumed. It is what is going to cancel display unevenness by adding the correction voltage which offsets this distortion to a driver voltage wave. The purpose is in offering the electronic equipment which canceled display unevenness by simple circuitry and carried the high display and the legible display of display grace and which was formed into small lightweight.
[0007]
[Means for Solving the Problem] The liquid crystal panel with which the liquid crystal display of the 1st this invention is formed so that two or more scan electrodes may be formed in one substrate of the substrate of the pair which pinches a liquid crystal layer and two or more signal electrodes may intersect said scan electrode at the substrate of another side, and the amount of this intersection becomes a display dot, The scan electrode drive circuit which supplies a driver voltage wave to said two or more scan electrodes of each of this liquid crystal panel, The signal-electrode drive circuit which supplies a driver

voltage wave to said two or more signal electrodes of each, The power circuit which generates two or more electrical potential differences which need two or more electrical potential differences and said signal-electrode drive circuits which need said scan electrode drive circuit to form the driver voltage wave supplied to said two or more scan electrodes of each to form the driver voltage wave supplied to said two or more signal electrodes of each, In the liquid crystal display possessing the amendment means which adds the correction voltage according to the alphabetic character and graphic form which said liquid crystal panel displays to at least said driver voltage [to which it is impressed by said scan electrode] wave-like, and said driver voltage wave-like one side which are impressed to said signal electrode The electrical potential difference which said amendment means generates in a part of said liquid crystal panel, said scan electrode drive circuit, said signal-electrode drive circuit, or power circuit [at least], Or a detection means to detect change of a current is provided and the description of making into said correction voltage said electrical potential difference which this detection means detects, or the electrical potential difference of the magnitude according to change of a current is carried out.
[0008] The liquid crystal display of the 2nd this invention is set to the liquid crystal display of the 1st this invention. Although said detection means forms the driver voltage wave of at least 1 scan electrode, and the driver voltage wave which said scan electrode drive circuit which said power circuit generates supplies to said two or more scan electrodes of each among said two or more scan electrodes of each of said liquid crystal panel It is characterized by detecting electrical-potential-difference change of a difference with at least one electrical potential difference among required electrical potential differences.

[0009] The liquid crystal display of the 3rd this invention is set to the liquid crystal display of the 1st this invention. It forms so that the substrate with which said scan electrode of said liquid crystal panel is formed may be intersected with said some of two or more signal electrodes [at least] in at least one or more electrical-potential-difference detection electrodes. Or it forms so that the substrate with which said signal electrode of said liquid crystal panel is formed may be intersected with said some of two or more scan electrodes [at least] in at least one or more electrical-potential-difference detection electrodes, and said detection means is characterized by detecting the voltage variation generated in said electrical-potential-difference detection electrode.
[0010] The liquid crystal display of the 4th this invention is characterized by detecting the current to which said detection means flows in said scan electrode drive circuit from said power circuit about at least one electrical potential difference which said power circuit supplies to said scan electrode drive circuit in the liquid crystal display of the 1st this invention.
[0011] It is characterized by for the liquid crystal display of the 5th this invention setting up the predetermined function with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables when change of the electrical potential difference or current which said detection means detects is plurality in the liquid crystal display of this invention of the 2nd, 3, or 4, and generating the correction voltage according to this function.
[0012] The liquid crystal display of the 6th this invention is characterized by being the function with which said function equalizes said two or more variables in the liquid crystal display of the 5th this invention.
[0013] The liquid crystal display of the 7th this invention is set to the liquid crystal display of the 3rd this invention. When said electrical-potential-difference detection electrode formed in said liquid crystal panel is plurality, generate two or more correction voltage which set up the predetermined function with which said amendment means makes change of the electrical potential difference which said detection means detects from said each electrical-potential-difference detection electrode two or more variables, and responded to this function, It is characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.
[0014] The liquid crystal display of the 8th this invention is characterized by said electrical-potential-

difference detection electrode having changed the area of the part which this electrical-potential-difference detection electrode, said two or more signal electrodes, or said scan electrode intersects respectively with said signal electrode or said scan electrode in the liquid crystal display of the 3rd this invention.

[0015] The liquid crystal display of the 9th this invention is set to the liquid crystal display of the 5th this invention. Two or more correction voltage which set up two or more predetermined functions with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables, and responded to these two or more functions is generated, It is characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.

[0016] The liquid crystal display of the 10th this invention is characterized by said amendment means generating the correction voltage according to the number of dots to which said detection means is [of said display dots of electrical-potential-difference change to detect and said liquid crystal panel] on in the liquid crystal display of the 3rd this invention.

[0017] The electronic equipment of the 11th this invention is characterized by providing the liquid crystal display of this invention of the 1st, 2, 3, 4, 5, 6, 7, 8, 9, or 10.

[0018]

[Example]

The drive approach of [example 1] this invention is explained in more detail using an example. Here, the case where the display unevenness first generated in the array direction of the signal electrode of a liquid crystal panel is canceled is explained.

[0019] Drawing 1 is drawing showing the configuration of this example. By a diagram, while consists of substrates 101 and 102 of the pair to which 10 pinches a liquid crystal layer (not shown) with a liquid crystal panel, and signal electrodes X1-X6 are formed in the scan electrodes Y1-Y6 and the substrate 102 of another side at the substrate 101. Here, respectively, the scan electrodes Y1-Y6 and signal electrodes X1-X6 are for this simplifying explanation with six, although it is few, and there are usually farther than this. [many]

[0020] 11 is X driver and 111-113 are a 6 bits shift register circuit, a 6-bit latch circuit, and the analog switching circuit of 4 circuit 1 6-bit contact with the internal configuration element, respectively. In addition, the number of bits is the number of the signal electrodes of a liquid crystal panel 10.

[0021] 12 is Y driver and 121 and 122 are a 6-bit shift register circuit and the analog switching circuit of 4 circuit 1 6-bit contact with the internal configuration element, respectively. In addition, the number of bits is the number of the scan electrodes of a liquid crystal panel 10. And a data signal, CK signal, LP signal, DI signal, and FR signal are incorporated from the exterior. The above configuration is the same as the configuration of the conventional technique.

[0022] 13 is a power circuit and it is the electrical-potential-difference V0-electrical-potential-difference V1= electrical-potential-difference V1-electrical-potential-difference V2= electrical-potential-difference V3-electrical-potential-difference V4= electrical-potential-difference V4-electrical potential difference V5 (= it sets with V.) about the electrical potential difference of 6 level required to drive a liquid crystal panel. electrical-potential-difference V0-electrical-potential-difference V5=n-V (n -- a positive number -- it is -- usually -- 10 order --) the case where the electrical potential differences V0-V5 which have unrelated relation are generated -- 131 -- an electrical-potential-difference dividing network -- it is -- from five resistors R1, R2, R3, R4, and R5 -- becoming -- resistors R1, R2, R4, and R5 -- R -- resistance -- having -- R3 -- R (n-4) -- it has resistance. If an electrical potential difference V0 and an electrical potential difference V5 are impressed to the both ends of this electrical-potential-difference dividing network 131, i.e., drawing, to the bottom of a resistor R5 a resistor R1 top, respectively, electrical potential differences V1, V2, V3, and V4 will be divided, respectively between each resistor R1, R2 and R2, and R3, R3, R4 andRR5 [4 and], and it will generate.

[0023] OP1-OP4 are voltage follower circuits which lower an impedance and output the electrical

potential differences V1, V2, V3, and V4 which the electrical-potential-difference dividing network 11 generated. Generally these voltage follower circuits OP1-OP4 are constituted by the operation amplifying circuit.

[0024] 132 is a reference voltage changeover switch and is a switch which changes and outputs an electrical potential difference V1 or an electrical potential difference V4 according to FR signal.

[0025] 133 is an input voltage change control circuit, and while Y driver is outputting the selection electrical potential difference to either of Y3 from the scan electrode Y1, it is a circuit which outputs the switch control signal 134 set to "1" in "0" while outputting the selection electrical potential difference to either of Y6 from the scan electrode Y4. Since it can form easily in the comparator circuit which compares the size as a result of the counting circuit where this circuit made LP signal the clock signal, and made DI signal the reset signal, and this counting circuit, especially the thing illustrated and explained is omitted.

[0026] 135 is an input voltage changeover switch, and when the switch control signal 134 is "1", it chooses and outputs the voltage waveform which outputs the electrical potential difference which the Y driver 12 outputs to the scan electrode Y2 to Y5 at the time of "0."

[0027] 136 is a differential amplifying circuit and outputs the difference of the electrical potential difference outputted from the reference voltage changeover switch 21 and the input voltage changeover switch.

[0028] 137 - 140 -- an electrical potential difference -- an adder circuit -- it is -- each -- the exterior -- from -- supplying -- having -- an electrical potential difference -- and -- voltage - a follower -- a circuit -- OP -- two -- OP -- three -- outputting -- an electrical potential difference -- V -- zero -- V -- two -- V -- three -- V -- five -- a differential amplifying circuit -- 136 -- outputting -- an electrical potential difference -- having added -- an electrical potential difference -- respectively -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- ****** -- outputting . The concrete example of 1 configuration of the electrical-potential-difference adder circuits 137-140 is shown in drawing 2 here. Either of the electrical potential differences V0, V2, V3, and V5 of drawing 1 inputs Terminal Vref by a diagram with the terminal which inputs reference voltage. Terminal Vin inputs the electrical potential difference which a differential amplifying circuit 136 outputs by drawing 2 . 201 forms a resistor by the capacitor, 202 forms a differential circuit, and 203 is a voltage follower circuit by the operation amplifying circuit. a terminal -- Vout -- voltage - a follower -- a circuit -- 203 -- an output -- drawing 1 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- corresponding . Here, since the electrical potential difference which the differential amplifying circuit 136 inputted into Terminal Vin by drawing 2 outputs is almost close to a differential wave, it can output the electrical potential difference which applied the electrical potential difference of Terminal Vin to the electrical potential difference of Terminal Vref in approximation from the voltage follower circuit 203 by connecting this electrical potential difference to the terminal Vin of the differential circuit which consists of resistance 201 and a capacitor 202.

[0029] and -- drawing 1 -- an electrical potential difference -- V -- zero -- V -- one -- V -- four -- V -- five -- Y -- a driver -- 12 -- supplying -- having -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- X -- a driver -- 11 -- supplying -- having . here -- Y -- a driver -- 12 -- supplying -- an electrical potential difference -- V -- five -- V -- one -- and -- X -- a driver -- 11 -- supplying -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- respectively -- the -- one -- an electrical potential difference -- a group -- selection -- an electrical potential difference -- un--- selection -- an electrical potential difference -- lighting -- an electrical potential difference -- astigmatism -- a LGT -- an electrical potential difference -- a call -- an electrical potential difference -- V -- zero -- V -- four -- V -- five -- ' -- V -- three -- ' -- respectively -- the selection electrical potential difference of the 2nd electrical-potential-difference group, a non-choosing electrical potential difference, a lighting electrical potential difference, and an astigmatism LGT electrical potential difference -- calling .

[0030] It has the above composition. In addition, about connection between each circuit, with drawing, since it is clear, explanation is omitted. And as shown in drawing 3 , a data signal, CK signal, LP signal, and DI signal are supplied from the outside.

[0031] Here, actuation is explained.
[0032] First, the X driver 11 incorporates the data signal which determines the contents of a display synchronizing with CK signal shown in drawing 3 one by one to a shift register circuit 111, and shifts it to it. And if only the number of signal electrodes of a liquid crystal panel 10 and the same number incorporate data to a shift register circuit 111, synchronizing with LP signal shown in drawing 3 , the contents of each bit of a shift register circuit 111 will be incorporated by each bit of a latch circuit 112. The level-shifter circuit 113 outputs the electrical potential difference according to the contents and the FR signal 15 which were incorporated to the latch circuit 112. That is, when the contents of each bit incorporated to the latch circuit 112 show lighting (henceforth referred to as "1".), a lighting electrical potential difference is outputted, and when the contents show an astigmatism LGT (henceforth referred to as "0".), an astigmatism LGT electrical potential difference is outputted. And the 1st electrical-potential-difference group is outputted about the case where it is shown that FR signal chooses the 1st electrical-potential-difference group (henceforth referred to as "0".), and the 2nd electrical-potential-difference group is outputted about the case where it is shown that FR signal chooses the 2nd electrical-potential-difference group (henceforth referred to as "1".).
[0033] The Y driver 12 incorporates DI signal shown in drawing 4 which determines the scan electrode chosen synchronizing with LP signal one by one to a shift register circuit 121, and shifts it to it. The level-shifter circuit 122 outputs the electrical potential difference according to the contents and the FRI signal 15 which were incorporated to the latch circuit 121. That is, when the contents of each bit incorporated to the latch circuit 112 show selection, a selection electrical potential difference is outputted, and when the contents show un-choosing, a non-choosing electrical potential difference is outputted. And the 1st electrical-potential-difference group is outputted about the case where the FR signal 15 is "0", and the 2nd electrical-potential-difference group is outputted about the case where FR signal is "1."
[0034] The electrical potential difference which the Y driver 12 outputs to the scan electrode Y2 in the period which outputs the electrical potential difference which the Y driver 12 outputs to the scan electrode Y5 in the period when, as for the input voltage change control circuit 133, a selection electrical potential difference impresses an input voltage changeover switch to Y3 from the scan electrode Y1 here to a differential amplifying circuit 136, and a selection electrical potential difference impresses to Y6 from the scan electrode Y4 is outputted to a differential amplifying circuit 136. Therefore, the electrical potential difference superimposed on distortion by the voltage waveform from which electrical potential differences V1 and V4 always change according to FR signal is outputted to 136.
[0035] In 132, at this time, a reference voltage changeover switch outputs either of the electrical potential differences V1 and V4 to a differential amplifying circuit 136 according to FR signal.
[0036] Therefore, only a part for distortion of the voltage waveform by which the Y driver 12 outputs a differential amplifying circuit 136 to the scan electrode Y2 or Y5 is outputted.
[0037] this -- distortion -- a part -- an electrical potential difference -- an adder circuit -- 137 - 140 -- an electrical potential difference -- V -- zero -- V -- two -- V -- three -- V -- four -- adding -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- four -- ' -- ****** -- the X driver 11 -- outputting .
[0038] The above actuation is performed.
[0039] Therefore, if distortion (this is set to Ve.) occurs on the electrical potential difference on the scan electrode which a non-choosing electrical potential difference (V1 or V4) impresses, the electrical potential difference on a scan electrode will serve as Vc+Ve. this -- the time -- a signal electrode -- a top -- an electrical potential difference -- an electrical potential difference -- V -- zero -- V -- one -- or -- V -- three -- V -- five -- Ve -- having added -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- or -- V -- three -- ' -- V -- five -- ' -- becoming . Therefore, the electrical-potential-difference difference of a scan electrode and a signal electrode is V0'. - V1= (V0+Ve) It is set to -(V1+Ve) =VV1-V2'=(V1+Ve)-(V2+Ve) =VV3'-V4=(V3+Ve)-(V4+Ve) =VV4-V5' =(V4+Ve)-(V5+Ve) =V, and a difference always becomes fixed regardless of the distorted magnitude sense. Therefore, a difference is lost to the effective voltage impressed to each dot of a liquid crystal panel 10, and display unevenness is

lost. This is shown in drawing 4 . the electrical potential difference V0 when drawing 4 performs the display with a liquid crystal panel 10 - an electrical potential difference V2, and an electrical potential difference V0 -- it is drawing showing a part of output wave of the Y driver 12 outputted to '-V2' and the scan electrode Y2 thru/or Y5.

[0040] 401-402 of a broken line show electrical potential differences V0-V2 by a diagram, and 404 of a continuous line and 406 show electrical-potential-difference V0' and the output wave of the Y driver 12 which shows V2' and outputs 405 of a continuous line to the scan electrode Y2 thru/or Y5. 407 and 408 -- respectively -- the output wave of electrical-potential-difference V0', and the V2' and the Y driver 12 -- the electrical-potential-difference difference of 405 is shown. [and] In addition, a few is shifted and it is displayed that 401-403 are legible. here -- the output wave of the Y driver 12 -- if 405 is distorted and voltage variation occurs, this will be followed and 404 and 406, electrical-potential-difference V0 [i.e.,],' and V1' will also change an electrical potential difference. By this, the electrical-potential-difference differences 407 and 408 become always fixed, without depending distorted. Here, although the 1st electrical-potential-difference group was explained, it becomes the same also about the 2nd electrical-potential-difference group.

[0041] Although a part for distortion of the voltage waveform which the Y driver 12 outputs was only added to the electrical potential difference supplied to the X driver 11, since the interior of a liquid crystal panel 10 is more greatly distorted from distortion of the voltage waveform which the Y driver 12 outputs, the electrical potential difference added to the electrical potential difference supplied to the X driver 11 in consideration of at this rate may be enlarged slightly. This can be easily set up by setting the gain of a differential amplifying circuit 136 as a suitable value. And it is not necessary to necessarily enlarge to distortion detected in this case at linearity.

[0042] In addition, although the scan electrode to refer to was set to Y2 and Y5 here, there is nothing that is limited to this, of course, and it is good even about the scan electrode of which location. Moreover, the distortion about two or more scan electrodes may be equalized and used.

[0043] By detecting the voltage variation on a scan electrode and fluctuating the electrical potential difference on a signal electrode corresponding to this, as stated above, display unevenness was simply [easily and] cancelable.

[0044] Although the [example 2] example 1 showed how to add correction voltage to the driver voltage wave of a signal electrode, the effectiveness that it is also easy to add correction voltage to the driver voltage wave of a scan electrode and same can be acquired. This example is explained. Drawing 5 is drawing showing an example of the configuration of this example.

[0045] By a diagram, except 531 - 533 in a power circuit 53, it is the same as drawing 1 , and since 53 carries out the same actuation, it attaches a jack per line and omits explanation in a power circuit.

[0046] 531 is a differential amplifying circuit, reverses a polarity and outputs the difference of the electrical potential difference outputted from the reference voltage changeover switch 21 and the input voltage changeover switch.

[0047] 532 and 533 are electrical-potential-difference adder circuits with the same circuitry as the electrical-potential-difference adder circuits 137-140 of drawing 1 , and output the electrical potential difference adding the electrical potential difference which a differential amplifying circuit 531 outputs to the electrical potential differences V1 and V4 which the voltage follower circuits OP1 and OP4 output as electrical-potential-difference V1' and V2', respectively.

[0048] And an electrical potential difference V0, V1', V4', and V5 are supplied to the Y driver 12 by drawing 1 , and electrical potential differences V0, V2, V3, and V5 are supplied to the X driver 11. Here, the electrical potential differences V0 and V2 supplied to the electrical potential difference V5, V1', and the X driver 11 which are supplied to the Y driver 12 turn into the selection electrical potential difference of the 1st electrical-potential-difference group, a non-choosing electrical potential difference, a lighting electrical potential difference, and an astigmatism LGT electrical potential difference, respectively, and an electrical potential difference V0, V4', and V5 and V3 become the selection electrical potential difference of the 2nd electrical-potential-difference group, a non-choosing electrical potential difference, a lighting electrical potential difference, and an astigmatism LGT electrical

potential difference, respectively.
[0049] When the electrical potential difference on a scan electrode tends to serve as Vc+Ve since it has the above composition if distortion (this is set to Ve.) tends to occur on the electrical potential difference on the scan electrode which a non-choosing electrical potential difference (V1 or V4) impresses namely, distortion in which they tend to generate the electrical potential difference of -Ve since the electrical-potential-difference adders 532 and 533 are added to electrical potential differences V1 or V4 is offset mostly. Therefore, on the non-choosing electrical potential difference on a scan electrode, distortion is almost lost, and display unevenness is lost.
[0050] Since the interior of a liquid crystal panel 10 is more greatly distorted from distortion of the voltage waveform which the Y driver 12 outputs, correction voltage added to the electrical potential difference supplied to the Y driver 12 in consideration of at this rate may be enlarged slightly. This can be easily set up by setting the gain of a differential amplifying circuit 531 as a suitable value. And it is not necessary to necessarily enlarge to distortion detected in this case at linearity.
[0051] Detecting the voltage variation on a scan electrode, as stated above, and fluctuating the electrical potential difference on a scan electrode corresponding to this was also able to cancel display unevenness.
[0052] Moreover, even if it applies correction voltage to both a signal electrode and the scan electrode of a driver voltage wave combining an example 1 and an example 2, there is same effectiveness.
[0053] An example besides [an example 3] is shown. In the examples 1 and 2, display unevenness was canceled by changing the electrical potential difference supplied to X driver or Y driver by distortion of the output wave of Y driver outputted to a specific scan electrode. Here, although JP,2-89,A for which the writer applied has explained in detail, if it says simply, distortion of the output wave of Y driver thru/or the voltage waveform on a scan electrode is prescribed by the total of change of an electrical potential difference to the scan electrode of each signal electrode. Therefore, an electrical-potential-difference detection electrode may be formed on the substrate with which the scan electrode of a liquid crystal panel is formed, capacity coupling of this electrical-potential-difference detection electrode may be carried out by the signal electrode and the liquid crystal layer, total of electrical-potential-difference change of a signal electrode may be detected, and the electrical potential difference which presumes the distortion on a scan electrode and is supplied to X driver from this result may be changed.
[0054] This is explained in more detail using drawing 6 . Drawing 6 shows the configuration of this example. Except liquid crystal panel 10a and power circuit 63, it is the same as the configuration of drawing 1 , and explanation is omitted by a diagram.
[0055] Liquid crystal panel 10a newly adds the electrical-potential-difference detection electrode YD on the substrate 101 of the liquid crystal panel 10 of drawing 1 by drawing 6 . The electrical-potential-difference detection electrode YD is provided so that all the signal electrodes X1-X6 may be countered, as shown in drawing. When the effects which make it generate from a signal electrode X1 here on the scan electrode by the electrical-potential-difference change on Xsix differ for every signal electrode, the width of face of the electrical-potential-difference detection electrode YD may be formed so that it may become large, as it hopes that it is not uniform, for example, becomes the right from the left.
[0056] 63 is a power circuit in drawing 6 , and since components other than 631 - 633 are the same as the power circuit 13 of drawing 1 , explanation is omitted. 631 forms a differential circuit by the capacitor which consists of an electrical-potential-difference detection electrode YD prepared on liquid crystal panel 10a by the resistor, and signal electrodes X1-X6 which counter this. 632 lowers an impedance and outputs the electrical potential difference generated in the electrical-potential-difference detection electrode YD in a voltage follower circuit. This voltage follower circuit 632 may not exist and may not necessarily be a twice [arbitration] as many noninverting amplifier as this in one 1 time the amplification factor of this. 633 is a switch which changes the electrical potential difference (it is henceforth called reference voltage) applied to the end of a resistor 631 in a switching circuit to an electrical potential difference V1 or an electrical potential difference V4. That is, when Y driver uses the electrical potential difference V1 as a non-choosing electrical potential difference and the electrical potential difference V4 is used for the electrical potential difference V1, an electrical potential

difference V4 is applied to the end of a resistor 631. more than -- a configuration -- becoming -- **** -- since -- voltage - a follower -- a circuit -- 632 -- each -- a signal electrode -- X -- one - six -- an electrical potential difference -- change -- total -- having responded -- voltage variation -- generating -- since -- this -- voltage variation -- using -- an electrical potential difference -- an adder circuit -- 137 - 140 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- generating .

[0057] The above configuration and actuation are carried out.
[0058] Therefore, since the same actuation as an example 1 is carried out, while acquiring the same effectiveness When the drive approach is not the electrical-potential-difference equalizing method (for example, when a liquid crystal panel is driven by the approach which the voltage waveform of a configuration which is different on the binary electrical potential difference shown by JP,60-247224,A etc. makes impress to a scan electrode, and drives) Since the configuration where the voltage waveforms of each scan electrode differed separately is carried out and it is difficult to carry out direct detection of the distortion of a scan electrode scan electrode, the approach of this example of presuming the distortion on a scan electrode with an electrical-potential-difference detection electrode is effective.
[0059] In addition, the switching circuit 631 is needed when the non-choosing electrical potential difference which the Y driver 12 uses uses two electrical potential differences of electrical potential differences V1 and V4. That is, it is because it is necessary to also change the reference voltage applied to the end of a resistor 631 when the non-choosing electrical potential difference which the Y driver 12 outputs changes from an electrical potential difference V1 (4) to V4 (1), in case total of the electrical-potential-difference change on the signal electrode to the non-choosing electrical potential difference which the Y driver 12 outputs is detected (when FR signal changes). Therefore, communalize a non-choosing electrical potential difference and Y driver is based on a non-choosing electrical potential difference. It is the group (it is not necessary to be necessarily 1 set) of the positive/negative electrical potential difference with the same absolute value about a selection electrical potential difference. By making X driver the configuration which moves by the positive/negative electrical potential difference with the same absolute value (it is not necessary to be necessarily 1 set) similarly as a configuration which moves The value of the reference voltage which the switching circuit 633 of comparatively high pressure-proofing which changes electrical potential differences V1 and V4 becomes unnecessary, and is applied to the end of a resistor 631 becomes good on the fixed electrical potential difference of arbitration. For example, reference voltage may be set as the electrical potential difference of the middle point of electrical potential differences V0 and V5.
[0060] Furthermore, when FR signal equivalent to the Y driver 12 of drawing 6 changes, even if it is Y driver of a configuration of that a non-choosing electrical potential difference changes from an electrical potential difference V1 (4) to V4 (1) When FR signal changes, also by making correction voltage a circuit (for example, switch of low pressure-proofing which short-circuits resistor 631) configuration which is not generated compulsorily, the value of the reference voltage which a switching circuit 633 becomes unnecessary and is applied to the end of a resistor 631 becomes good on the fixed electrical potential difference of arbitration.
[0061] Moreover, although correction voltage is added to the driver voltage wave of a signal electrode in this example, the same effectiveness as an example 2 is acquired by preparing the inversed amplification which reverses the polarity of the electrical potential difference which the voltage follower circuit 632 outputs, and adding this to the driver voltage wave of a scan electrode by making this output voltage into correction voltage.
[0062] The distortion of the output wave of [an example 4] and also Y driver thru/or the voltage waveform on a scan electrode is generated when a current flows to Y driver and a scan electrode. And this current flows into a power circuit through Y driver. Therefore, distortion can be presumed by detecting the current which flows to this power circuit. Change, now ** are good in the electrical potential difference supplied to X driver by this.
[0063] This is explained in more detail using drawing 7 . Drawing 7 shows the configuration of this example. Except power circuit 73, it is the same as the configuration of drawing 1 , and explanation is

omitted by a diagram. Since components other than resistors 731 and 732, a differential amplifying circuit 733, and 734 are still the same as the power circuit 13 of drawing 1 in the power circuit 73 of drawing 6 , explanation is omitted. Resistors 731 and 732 have minute resistance by current detection resistance, and the both ends of a resistor are made to generate the electrical potential difference proportional to the current which flows to this resistor. Differential amplifying circuits 733 and 734 output the electrical-potential-difference difference generated to the both ends of resistors 731 and 732, respectively to an electrical-potential-difference adder circuit. this -- an electrical potential difference -- a difference -- being based -- an electrical potential difference -- an adder circuit -- 137 - 140 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- generating . The above configuration and actuation are carried out.

[0064] Therefore, since the same actuation as an example 1 is carried out, while acquiring the same effectiveness, the reference voltage changeover switch 132 which was required of the example 1, the input voltage change control circuit 133, and the input voltage changeover switch 135 can simplify needlessness and a collapsibility circuit.

[0065] Moreover, the same effectiveness as an example 2 is acquired by adding this to the driver voltage wave of a scan electrode by making into correction voltage the electrical potential difference which reversed the polarity of the electrical potential difference which differential amplifying circuits 733 and 734 output.

[0066] In addition, although this example showed how to detect the current of a non-choosing electrical potential difference The electrical potential difference impressed to each signal electrode distortion which each signal electrode generates in the driver voltage wave on a scan electrode (non-choosing electrical potential difference) From a lighting electrical potential difference to an astigmatism LGT electrical potential difference Since it is exactly the total of a current which flows to each signal electrode when changing from an astigmatism LGT electrical potential difference to a lighting electrical potential difference For example, distortion generated in the driver voltage wave on a scan electrode (non-choosing electrical potential difference) also by the resistor of a minute value etc. detecting respectively the current of the lighting electrical potential difference supplied to the X driver 11 of drawing 7 and an astigmatism LGT electrical potential difference, and adding it can be presumed. It can also make it easy to make correction voltage and the same effectiveness is acquired by this.

[0067] In the [example 5] examples 1-4, the display unevenness generated in the array direction of the signal electrode of a liquid crystal panel was canceled. Here, the example which cancels the display unevenness (this display unevenness is henceforth called weft length.) generated in the array direction of the scan electrode of a liquid crystal panel next is shown. Although JP,2-89,A for which the writer applied has explained this weft length in detail If it says simply, when more display dots on each scan electrode will light up In order to become blunt mostly by the time of the capacity of the capacitor which the display dot on this scan electrode makes becoming large, and the driver voltage wave of a scan electrode changing from a non-choosing electrical potential difference to a selection electrical potential difference, the effective voltage impressed to the display dot on that scan electrode becomes small, and weft length occurs. That is, weft length is prescribed by the wave-like amount of provincial accents when changing to a selection electrical potential difference.

[0068] Therefore, this display unevenness is cancelable by forming an electrical-potential-difference detection electrode on the substrate with which the signal electrode of a liquid crystal panel is formed, carrying out capacity coupling of this electrical-potential-difference detection electrode by the signal electrode and the liquid crystal layer, detecting total of electrical-potential-difference change of a scan electrode, and changing the selection electrical potential difference which presumes the provincial accent on a scan electrode and is supplied to Y driver from this result.

[0069] This is explained in more detail using drawing 8 . Drawing 8 shows the configuration of this example. Except liquid crystal panel 10b and power circuit 83, it is the same as the configuration of drawing 1 , and explanation is omitted by a diagram.

[0070] Liquid crystal panel 10b newly adds the electrical-potential-difference detection electrode XD on the substrate 102 of the liquid crystal panel 10 of drawing 1 by drawing 8 . The electrical-potential-

difference detection electrode XD is provided so that all the scan electrodes Y1-Y6 may be countered, as shown in drawing.
[0071] 83 is a power circuit in drawing 8 , and since components other than 831 - 833 are the same as the power circuit 13 of drawing 1 , explanation is omitted. 831 reverses the electrical potential difference which the voltage follower circuit 632 outputs in inversed amplification. 832 and 833 carry out the same circuitry and the same function as an adder 137 of drawing 1 with an adder.
[0072] It has the above composition. Here, liquid crystal panel 10b shows the voltage waveform on the electrical potential difference which the voltage follower circuit 632 in the case of performing a display which the display dot on the scan electrode Y3 turned on, and the display dot on other scan electrodes has turned on few outputs, and each scan electrode typically to drawing 9 R> 9. [many] As for the voltage waveform to which the voltage follower circuit 632 outputs 901 by a diagram, and 902-904, the voltage waveform on the scan electrode Y2 - Y4 is shown respectively. In addition, 902-904 are the voltage waveforms at the time of presupposing that correction voltage is not temporarily added to the drive wave of a scan electrode. Here, a voltage waveform 901 serves as total of change of all the voltage waveforms of scan electrode Y1-6, and the part which a sequential selection electrical potential difference changes to scan electrode Y2-4, and is impressed to them by a diagram is shown.
[0073] Since the voltage waveform 903 on the scan electrode Y3 becomes blunt greatly and it becomes a selection electrical potential difference when the scan electrode which a selection electrical potential difference impresses to Y3 changes from the scan electrode Y2, as drawing 9 shows, the big differential wave of the magnitude as this also with the almost same electrical potential difference 901 which the voltage follower circuit 632 outputs is generated. And since the voltage waveform 904 on the scan electrode Y4 becomes a selection electrical potential difference, without hardly becoming blunt when the scan electrode which a selection electrical potential difference impresses to Y4 changes from the scan electrode Y3, a differential wave also with the small electrical potential difference 901 which the voltage follower circuit 632 outputs is generated.
[0074] Here, the polarity reversals of the output of the voltage follower circuit 632 are carried out in inversed amplification 831, and it is added to a selection electrical potential difference with adders 832 and 833 by making this into correction voltage.
[0075] Therefore, since the selection electrical potential difference to which bigger correction voltage was added impresses when the voltage waveform 903 on the scan electrode Y3 tends to become blunt greatly and it is going to become a selection electrical potential difference, it is right set so that a selection electrical potential difference may be reached more early in fact.
[0076] Therefore, how to become blunt when changing from a non-choosing electrical potential difference to a selection electrical potential difference mostly, without being based on the number which has turned on the display dot on each scan electrode becomes almost the same, and can prevent weft length.
[0077] [Example 6] Further, although a voltage waveform becomes blunt greatly when many [a selection electrical potential difference is impressed by a certain scan electrode, and many display dots on this scan electrode are on and] since the distortion of the output wave of Y driver thru/or the voltage waveform on a scan electrode is generated when a current flows to Y driver and a scan electrode, the current of many [this] is not flowing to this scan electrode. Therefore, distortion can be presumed by detecting the current which flows to this scan electrode, and the current which flows into the part which in other words generates the selection electrical potential difference of a power circuit. By this, the electrical potential difference supplied to Y driver may be changed.
[0078] This is explained in more detail using drawing 10 . Drawing 10 shows the configuration of this example. Except power circuit 103, it is the same as the configuration of drawing 7 , and explanation is omitted by a diagram. Since components other than resistors 1031 and 1032, differential amplifying circuits 1033 and 1034, an adder 1035, and 1036 are still the same as the power circuit 73 of drawing 7 in the power circuit 103 of drawing 10 , explanation is omitted. Resistors 1031 and 1032 have minute resistance by current detection resistance, and the both ends of a resistor are made to generate the electrical potential difference proportional to the current which flows to this resistor. Differential

amplifying circuits 1033 and 1034 output the electrical potential difference which acted as arbitration Bai of the electrical-potential-difference difference generated to the both ends of resistors 1031 and 1032, respectively to an electrical-potential-difference adder circuit, respectively. The electrical-potential-difference adder circuits 1035 and 1036 add these electrical-potential-difference differences to electrical potential differences V0 and V5, respectively, and electrical-potential-difference V0' and V5' are generated. The above configuration and actuation are carried out.
[0079] Therefore, since a big current flows to resistors 1031 and 1032 when a selection electrical potential difference is impressed by a certain scan electrode and the voltage waveform on this scan electrode considers as a raw wax greatly, electrical-potential-difference V0' and V5' become the electrical potential difference of a big absolute value from electrical potential differences V0 and V5 to a non-choosing electrical potential difference. Therefore, the big provincial accent of the voltage waveform on this scan electrode is canceled. The same effectiveness as an example 5 is acquired by this.

[0080] In the [example 7] example 3, the electrical-potential-difference detection electrode was formed one on the substrate with which the scan electrode of a liquid crystal panel is formed, capacity coupling of this electrical-potential-difference detection electrode was carried out by the signal electrode and the liquid crystal layer, total of electrical-potential-difference change of a signal electrode was detected, and the electrical potential difference which presumes the distortion on a scan electrode and is supplied to X driver from this result was changed. However, if the number of scan electrodes increases, it puts in another way and the die length of each signal electrode becomes long, it may be difficult for the degrees of electrical-potential-difference change to differ in the part near X driver of each signal electrode, and a far part, and to presume the distortion on a scan electrode correctly. In such a case, what is necessary is to generate the correction voltage made into the existing suitable function which makes these electrical potential differences a variable, and just to add this correction voltage to the drive wave of a signal level by this, if weighting of the electrical potential difference which forms two or more electrical-potential-difference detection electrodes, and these electrical-potential-difference detection electrodes detect is carried out suitably and it is respectively put in another way.
[0081] This is explained in more detail using drawing 11 . Drawing 11 shows the configuration of this example. Except liquid crystal panel 10c and power circuit 113, it is the same as the configuration of drawing 1 , and explanation is omitted by a diagram.
[0082] By drawing 11 , liquid crystal panel 10c is provided in the up-and-down both-sides section so that all the signal electrodes X1-X6 may newly on the substrate 101 of the liquid crystal panel 10 of drawing 1 be countered in the electrical-potential-difference detection electrode 1 and YD 2, as shown in drawing, respectively. When the effects which make it generate from a signal electrode X1 here on the scan electrode by the electrical-potential-difference change on Xsix differ for every signal electrode, the width of face of the electrical-potential-difference detection electrode YD may be formed so that it may become large, as it hopes that it is not uniform, for example, becomes the right from the left.
[0083] 1130 is a power circuit in drawing 11 , and since components other than 6311, 6312, 6321, 6322, 1131 - 1134 are the same as the power circuit 13 of drawing 1 , explanation is omitted. 6311 and 6312 form a differential circuit by the capacitor which the electrical-potential-difference detection electrode 1 and YD 2 becomes from the signal electrodes X1-X6 which counter this by the resistor, respectively. 6321 and 6322 lower an impedance and output the electrical potential difference generated in the electrical-potential-difference detection electrode 1 and YD 2 in a voltage follower circuit, respectively. In addition, this circuit may not necessarily be the noninverting amplifier of one 1 time the scale factor [scale factor of arbitration instead of an amplification factor] of this. 1131 - 1134 -- an adder -- an electrical potential difference -- V -- zero -- V -- two -- V -- three -- V -- five -- two -- a ** -- voltage - a follower -- a circuit -- 6321 -- two -- outputting -- an electrical potential difference -- adding -- respectively -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- generating .
[0084] The above configuration and actuation are carried out. Here, the example of 1 configuration of adders 1131-1134 is shown in drawing 12 . By a diagram, 1201 forms 1202, a resistor and 1203 form

the differential circuit of 2 inputs by the capacitor, and 1204 is a voltage follower circuit by the operation amplifying circuit. Moreover, a terminal 1 and Vin 2 inputs the electrical potential difference which the voltage follower circuits 6321 and 2 of drawing 11 output, respectively, and Terminal Vref inputs one electrical potential difference of the electrical potential differences V0, V2, V3, and V5. drawing 12 -- a terminal -- Vout -- voltage - a follower -- a circuit -- 203 -- an output -- drawing 11 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- corresponding . Here, since the electrical potential difference which the voltage follower circuits 6321 and 2 inputted into Terminal Vin by drawing 12 output is almost close to a differential wave, it can output the electrical potential difference which applied the electrical potential difference of a terminal 1 and Vin 2 to the electrical potential difference of Terminal Vref in approximation from the voltage follower circuit 1204 by connecting these electrical potential differences to the terminal 1 and Vin 2 of the differential circuit which consists of resistance 1201 and capacitors 1202 and 1203.

[0085] Here, it was equalized, when electrostatic capacity of capacitors 1202 and 1203 was made the same, and becoming the correction voltage by which weighting was carried out equally and putting in another way the electrical potential difference of a terminal 1 and Vin 2 as a result. Moreover, contribution to the correction voltage of electrical-potential-difference change of the electrical-potential-difference detection electrode YD2 can be enlarged by making electrostatic capacity of 1203 larger than a value 1202 which is different in the electrostatic capacity of these two capacitors, for example, a capacitor.

[0086] The electrostatic capacity of these capacitors 1202 and 1203 can be easily set up in an experiment etc. Moreover, contribution to correction voltage can be similarly enlarged by setting up the electrostatic capacity of capacitors 1202 and 1203 similarly, and making YD2 broader than the electrical-potential-difference detection electrode YD1 of drawing 11 , for example.

[0087] Therefore, since distortion generated in the drive wave on a scan electrode by two or more-izing [carrying out the same actuation as an example 3, and / an electrical-potential-difference detection electrode] further was detected more correctly, display unevenness was more cancelable.

[0088] In addition, the effectiveness same also about weft length as this example is acquired by forming two or more electrical-potential-difference detection substrates in the both-sides section on either side like the example 5 over an example 3, so that it may counter on the substrate with which the signal electrode is formed at all the scan electrodes Y1-Y6, and making a power supply section into the same circuitry.

[0089] Although the electrical potential difference of the function which made the electrical potential difference which forms two or more electrical-potential-difference detection electrodes on the substrate with which the scan electrode of a liquid crystal panel is formed, and is generated in these electrical-potential-difference detection electrodes two or more variables was used as one correction voltage in the [example 8] example 7 For example, when total of change of the signal electrode on the left-hand side of a liquid crystal panel of a driver voltage wave completely differs from total of change of a right-hand side signal electrode of a driver voltage wave, the direction which applied correction voltage which is different in these signal electrodes can cancel display unevenness more. Therefore, display unevenness is further improvable by adding the correction voltage to the driver voltage wave for every signal electrode or scan electrode which the electrical-potential-difference detection electrode which is made to generate two or more correction voltage from electrical-potential-difference change obtained from two or more electrical-potential-difference detection electrodes, and is made to generate a certain correction voltage about such correction voltage intersects according to an individual. This is explained in more detail using drawing 13 . The example of 1 configuration of this example is shown in drawing 13 .

[0090] Since the Y driver 12 carries out the same configuration and the actuation as Y driver of drawing 1 , it omits explanation by a diagram.

[0091] 10d is a liquid crystal panel in drawing 13 , and as the electrical-potential-difference detection electrode 1 and YD 2 newly on the substrate 101 of the liquid crystal panel 10 of drawing 1 shows in drawing, it is compared by each, and it has prepared in the upper edge part so that some signal electrodes X1-X6 may be countered respectively. Here, the comparison part of the electrical-potential-

difference detection electrode 1 and YD 2 is shared between this example with the signal electrode (this example signal electrodes X2-X5) used as a wedge shape, and crosses. However, it not necessarily compares and there is no need that the section shares with the same signal electrode and crosses. It is not necessary to separate two more electrical-potential-difference detection electrodes 1 and YD 2. That is, you may make it have connected too hastily.

[0092] 11L, 11M, and 11R are X drivers, and except that the configuration numbers of bits of each circuit of the X driver 11 of drawing 1 and the interior differ, they carry out the same configuration and actuation. And the electrical potential difference of an electrical-potential-difference configuration different, respectively is supplied to these X drivers 11L, 11M, and 11R, and a driver voltage wave is respectively outputted with this electrical potential difference.

[0093] 133 is a power circuit, and since the configuration and actuation of those other than 1331 - 1333 are the same as the power circuit 1130 of drawing 11 , explanation is omitted.

[0094] 1331 and 1333 consist of an adder shown by drawing 2 by the adder group, and are prepared corresponding to electrical potential differences V0, V2, V3, and V5.

[0095] 1332 is an adder group, and this adder consists of an adder shown by drawing 12 R> 2, and is formed corresponding to electrical potential differences V0, V2, V3, and V5.

[0096] The electrical potential difference which the adder groups 1331, 1332, and 1333 output is supplied to the X drivers 11L, 11M, and 11R, respectively.

[0097] Since it has the above composition, in the electrical-potential-difference detection electrode YD1, total of electrical-potential-difference change of the driver voltage wave to signal-electrode X1-5 occurs. Here, weighting of electrical-potential-difference change of a driver voltage wave is small, so that it goes to X5 from a signal electrode X1, since the point of the electrical-potential-difference detection electrode YD1 serves as a wedge shape. Although total of the electrical-potential-difference change of the driver voltage wave to signal-electrode X1-5 also to the electrical-potential-difference detection electrode YD2 occurs similarly, weighting of electrical-potential-difference change of a driver voltage wave is small, so that it goes to X1 from a signal electrode X5.

[0098] Therefore, the voltage follower circuit 6321 mainly outputs total of electrical-potential-difference change of the signal electrode on the left-hand side of 10d of liquid crystal panels of a driver voltage wave, and the voltage follower circuit 6322 mainly outputs total of electrical-potential-difference change of a right-hand side signal electrode of a driver voltage wave.

[0099] Here, the output voltage of the voltage follower circuit 6321 is supplied to the adder group 1331 as correction voltage, and the output of the adder group 1331 is supplied to X driver 11L. Similarly, the output voltage of the voltage follower circuit 6322 is supplied to the adder group 1333 as correction voltage, and the output of the adder group 1333 is supplied to X driver 11R. And the output of the voltage follower circuits 6321 and 6322 is supplied to the adder group 1332 as two correction voltage, and the adder group 1332 outputs the electrical potential difference which added the correction voltage which equalized these two correction voltage to X driver 11M.

[0100] Since the above actuation is carried out, the correction voltage by total of change of a driver voltage wave by which many weighting to change of the signal electrode of this left-hand side of a driver voltage wave was carried out to the driver voltage wave of the signal electrode on the left-hand side of 10d of liquid crystal panels will be added, the correction voltage by which many weighting to change of a right-hand side signal electrode of a driver voltage wave was carried out to the driver voltage wave of a left-hand side signal electrode will be added, and the correction voltage which right and left equalized will be added in the center section.

[0101] therefore -- the driver voltage wave of each signal electrode -- abbreviation -- the optimal correction voltage was able to be added separately and was able to cancel display unevenness further.

[0102] In addition, although the adder groups 1331 and 1333 were used as the adder shown by drawing 2 in this example, it considers as the adder shown by drawing 12 , and two outputs of the voltage follower circuits 6321 and 6322 are inputted like the adder group 1332, and with the electrostatic capacity of the capacitors 1202 and 1203 of drawing 12 , the amount contributed of these two input voltage may be set up suitably, and may be outputted.

[0103] Moreover, at this example, although the number of different correction voltage was set to 3, this may be suitably fluctuated in the magnitude of a liquid crystal panel etc.
[0104] Furthermore, although this example showed the approach which used the electrical-potential-difference detection electrode For example, the lighting electrical potential difference supplied to these X drivers about each of X driver 11L of drawing 13 , and M and R, Also by the resistor of a respectively minute value etc. detecting the current of an astigmatism LGT electrical potential difference respectively, and adding it, two or more of the same correction voltage as this example can be obtained, and the same effectiveness as this example is acquired by performing same amendment using this.
[0105] As mentioned above, display unevenness was able to be further canceled by making correction voltage which adds that it stated into the correction voltage which changed with places in which the liquid crystal panel of a signal electrode is located.
[0106] Although the electrical potential difference of the function which made the electrical potential difference which forms two or more electrical-potential-difference detection electrodes on the substrate with which the scan electrode of a liquid crystal panel is formed, and is generated in these electrical-potential-difference detection electrodes two or more variables was used as three correction voltage in the [example 9] example 8 for example, the electrical potential difference which forms one electrical-potential-difference detection electrode, and is generated in this electrical-potential-difference detection electrode -- since -- three correction voltage is generated and one correction voltage in the driver voltage wave of the signal electrode according to individual may be added. For example, when the terminal which impresses the driver voltage wave of the scan electrode of a liquid crystal panel in a writer's etc. experiment was in left-hand side, by adding the correction voltage which amplified greatly the correction voltage which amplified small the electrical potential difference obtained from one electrical-potential-difference detection electrode to the signal electrode located in the left-hand side of a liquid crystal panel to the signal electrode located in the right-hand side of a liquid crystal panel showed experimentally that display unevenness was solved more. This is shown in drawing 14 . Drawing 14 shows the example of 1 configuration of this example.
[0107] 10a has a liquid crystal panel and the composition as drawing 6 with 12 [same at Y driver] by a diagram, and 11L, and M and R have the same composition as drawing 13 by X driver.
[0108] Further 143 has the same composition as the power circuit 63 of drawing 6 in the power circuit except 1431 - 1433. Then, these explanation is omitted.
[0109] It consists of adders which show 1431-1433 to drawing 2 by the adder group by drawing 14 , respectively. However, the capacity of the capacitor 202 of drawing 2 R> 2 is small by the adder group 1431, is large at 1433, and takes a value in the meantime in 1432.
[0110] That is, but, the adder group 1431 has the smallest correction voltage with the same electrical potential difference which joins Terminal Vin added, and it is set up so that 1432 and 1433 may next become the largest.
[0111] Since two or more correction voltage could be generated from the electrical potential difference obtained from the electrical-potential-difference detection electrode since it had become the above configuration and big correction voltage added the further signal electrode from the drive terminal of a scan electrode to the driver voltage wave, display unevenness was able to be canceled further.
[0112] In [example 10] example 3 grade, although the configuration of an electrical-potential-difference detection electrode was not described especially in detail, display unevenness can be further canceled by changing the configuration of an electrical-potential-difference detection electrode depending on the configuration of a liquid crystal panel. This is explained using drawing 15 . Drawing 15 is drawing showing the configuration of a liquid crystal panel. This Fig. is the same except that liquid crystal panel 10a of drawing 14 differs from the configuration of each electrode. Here, the configuration of the scan electrodes Y1-Y6 is carrying out the same configuration as liquid crystal panel 10a, and, as for signals X1-X6, the terminal with which driver voltage is supplied alternately with the upper and lower sides is formed. (In drawing 15 , this terminal is formed for the signal electrode of X1, 3 and 5, and an odd number upwards.) Here, the electrical-potential-difference detection electrode YD is formed so that each signal electrode may be intersected at a part for an upper edge part. And in the part which intersects the

signal electrode of an odd number, the electrical-potential-difference detection electrode YD has narrow width of face, and by the part which intersects the signal electrode of an even number, it is formed so that width of face may become large.

[0113] The electrical-potential-difference detection electrode YD is formed in the above configurations.

[0114] By this, capacity coupling of a signal electrode with the near terminal which driver voltage impresses, and the electrical-potential-difference detection electrode YD becomes small, and capacity coupling of a signal electrode with the far terminal which driver voltage impresses, and the electrical-potential-difference detection electrode YD becomes large. Therefore, the electrical-potential-difference detection electrode YD is made to generate a differential electrical potential difference in small weighting in the location of the electrical-potential-difference detection electrode YD by change of a driver voltage wave on the signal electrode of an odd number with little attenuation, and the change of a driver voltage wave on the signal electrode of the big even number of attenuation makes the electrical-potential-difference detection electrode YD generate a differential electrical potential difference in big weighting.

[0115] Therefore, the electrical-potential-difference detection electrode YD can incorporate equally electrical-potential-difference change of a signal electrode with the far terminal which impresses a driver voltage wave, and a near signal electrode to the electrical-potential-difference detection electrode YD. Since distortion more correctly generated on a scan electrode can be guessed, as a result more exact correction voltage can be generated by this, display unevenness can be canceled further.

[0116] In the [example 11] example 3 grade, the electrical potential difference which amplified the electrical potential difference which the electrical-potential-difference detection electrode detected for the fixed scale factor was made into correction voltage. Here, the electrical-potential-difference difference of an electrical-potential-difference detection electrode and the signal electrode which counters is 0V in general. However, the electrical-potential-difference difference of an actual scan electrode and the signal electrode which counters is about several V in effective voltage. If the effective voltage which generally impresses liquid crystal becomes large, the dielectric constant will become large. This means that the electrostatic capacity of the capacitor which a liquid crystal panel makes becomes large, when many display dots of a liquid crystal panel light up. Therefore, total of electrical-potential-difference change of a signal electrode of a drive wave makes the driver voltage wave on each scan electrode generate but more much same distortion. However, a display does not depend the degree of capacity coupling of an electrical-potential-difference detection electrode and the signal electrode which counters how, but since it is fixed, correction voltage will run short with some of numbers of lighting dots of a display. Therefore, the display which the number of lighting dots is not caused how and does not have display unevenness can be performed by fluctuating the amount of correction voltage with some of numbers of lighting dots of a display. Drawing 1616 explains this. Drawing 16 shows the example of 1 configuration of this example. The configuration of those other than a power circuit 163 and number counting circuit of lighting dots 164 is the same as the configuration of drawing 6 , and omits explanation by a diagram. 164 of drawing 16 R> 6 consists of a scaling circuit 1641 and a latch circuit 1642 in the number scaling circuit of lighting dots. It sets enumerated data to 0 and starts counting again at the same time it counts up a scaling circuit 1641 synchronizing with CK signal when a data signal is "1", and it makes a latch circuit 1642 incorporate enumerated data synchronizing with DI signal. The output of a latch circuit 1642 is incorporated by the adjustable amplifier 1631 of a power circuit 163.

[0117] 163 of the configuration of those other than 1631 is the same as that of the configuration of drawing 6 in a power circuit, and omits explanation. 1631 is an amplifying circuit where an amplification factor becomes large, when the numeric value of the number counting circuit 164 of lighting dots becomes large with adjustable amplifier. The example of 1 configuration of this circuit is shown in drawing 17 .

[0118] It is drawing, and by the resistor, 173 has the resistance of the one half of 174 and, in an operational amplifier, and 172-175, 174 has [171] the resistance of the one half of 175. 176-178 are respectively connected to resistors 172-175 in the switching circuit at juxtaposition. Although these

resistance and switching circuits are three pieces in this example, this number may be fluctuated suitably. The output of the switching circuit 603 of drawing 16 and the output of the voltage follower circuit 632 are connected to Vref and a Vin terminal, respectively. Therefore, the electrical potential difference which the non-inversed amplifying circuit with the amplification factor by the ratio of the resistance of resistance 172 and the resistance between resistors 173 and 175 was formed, and was inputted into the Vin terminal on the basis of the electrical potential difference of a Vref terminal is amplified and outputted with this amplification factor. Here, ON/OFF control of the switching circuits 176-178 is carried out for the binary numeric value which is two or more bits which the number scaling circuit 164 of lighting dots outputs. That is, OFF and in the case of "0", it is turned on when a binary numeric value is "1." Moreover, the numeric value of a high order controls a switching circuit 178, and a low-ranking numeric value controls a switching circuit 176. Thereby, if a numeric value becomes large, the resistance between resistors 173 and 175 will become large in proportion to this. Therefore, an amplification factor will become large if the number of lighting dots increases.

[0119] Since it has the above composition, if many display dots of liquid crystal panel 10a light up, the display in which correction voltage also becomes large, and the number of lighting dots does not depend it how, but no display unevenness is can be performed.

[0120] Although correction voltage was added to the electrical potential difference supplied to the X driver 11 by detecting the current which flows on the non-choosing electrical potential difference in a power circuit 73 (V1, V4) in the [example 12] example 4, correction voltage may be added to the electrical potential difference supplied to the Y driver 12. This is explained using drawing 18 . Drawing 18 shows the concrete example of 1 configuration of this example. Except power circuit 183, it is the same as the configuration of drawing 1 , and explanation is omitted by a diagram. 141 in a power circuit 183, and OP2 and OP3 are still the same as the jack per line of drawing 1 respectively. 1810 and 1840 are electrical-potential-difference amendment circuits which add correction voltage to electrical potential differences V1 and V4, respectively, and are prepared between the electrical-potential-difference dividing network 131 and the Y driver 12. The electrical-potential-difference amendment circuits 1810 and 1840 serve as the same circuitry, and show the concrete example of 1 configuration of the electrical-potential-difference amendment circuits 1810 and 1840 to drawing 19 . Although a non-choosing electrical potential difference explains hereafter the period when an electrical potential difference V1 is used in examples 12-16 here according to FR signal, the same is said of the period when an electrical potential difference V4 is used. In drawing 19 , a Vin terminal is a terminal which inputs an electrical potential difference V1 (or V4). 1911 is a resistor for current detection and the electrical potential difference proportional to the total of a current which flows to the scan electrode with which a non-choosing electrical potential difference is impressed generates it to the both ends. This electrical potential difference is impressed to the inversed amplification 1912 constituted by the operational amplifier 1913 and resistors 1914 and 1915. The electrical potential difference (this is set to Vd) which an inversed amplifier 1912 outputs can be made almost equal to the electrical potential difference on the scan electrode with which the non-choosing electrical potential difference distorted under the effect of the transient current was impressed by setting the amplification factor of inversed amplification 1912 as a suitable value with the resistance of resistors 1914 and 1915. An operational amplifier 1916 outputs the electrical potential difference (this is set to Vc) made into electrical potential differences [electrical potential difference / from the Vin terminal impressed to electrical-potential-difference V1' impressed to the reversal input of an operational amplifier 1916, and a noninverting input] to the Y driver 12.

[0121] Since the above configuration and actuation are carried out, also when the transient current flows, the electrical potential difference and electrical potential difference V1 (or electrical potential difference V4) on the scan electrode which the non-choosing electrical potential difference impressed are maintained at the always same electrical potential difference.

[0122] As mentioned above, by detecting the current which flows on the non-choosing electrical potential difference in a power circuit (electrical potential differences V1 and V4), as stated, and adding correction voltage to the non-choosing electrical potential difference supplied to the Y driver 12,

fluctuation of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed could be suppressed, like the example 1, it could be easy and display unevenness was able to be canceled simply.

[0123] There may not be the need that the circuitry of the electrical-potential-difference amendment circuits 1810 and 1840 of the [example 13] example 12 is a configuration shown by drawing 19 , and other circuitry is sufficient as it. Here, an example of other circuitry of an electrical-potential-difference amendment circuit is shown in drawing 20 . About 1911-1916 of drawing 2020 , the jack per line of drawing 19 is supported, respectively. 2017 is a capacitor and sets up the time constant tau 1 of inversed amplification 1912 in combination with a resistor 1914. Similarly, 2018 and 2019 set up the time constant tau 2 of the operation amplifying circuit 1916 by the resistor and the capacitor, respectively.

[0124] It has the above composition, and also when the transient current flows on an electrical potential difference V1 (or V4) by setting the value of these time constants tau1 and tau2 and the amplification factor mentioned above in the example 12 as a suitable value, the effective voltage value per 1LP signal cycle of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed can be made equal to an electrical potential difference V1, and there is the same effectiveness as an example 12. Furthermore, since the electrical-potential-difference variation per unit time amount of the output voltage of amplifying circuits 1913 and 1916 became small, it could use the cheap operational amplifier with a low slew rate, and the stability of a circuit was also able to raise it. In addition, although this example described the case where the current of the non-choosing electrical potential difference which flows the inside of a power circuit was detected, also when detecting the current of a selection electrical potential difference, and generating correction voltage using an electrical-potential-difference detection electrode further, the same effectiveness is acquired by taking the same circuitry.

[0125] Although the resistor with minute resistance detected the current which flows all over a power circuit in the [example 14] example 12 and 13 grades, there is no need of not necessarily using a resistor for current detection, and it may use other components. Here, the concrete example of 1 configuration of the electrical-potential-difference amendment circuit at the time of using a transformer for drawing 21 as other components as a substitute of the electrical-potential-difference amendment circuit of the electrical-potential-difference amendment circuits 1910 and 1940 of drawing 19 is shown. The operation amplifying circuit 1916 of drawing 21 is the same as the thing of the jack per line of drawing 19 . 2120 is a transformer and consists of a primary coil 2121 and a secondary coil 2122. Here, the same effectiveness as an example 12 was acquired by making the ratio of the number of turns of the primary coil 2121 and the secondary coil 2122 into a suitable value. Furthermore, the number of components was able to be lessened.

[0126] Here, the example of a configuration of other electrical-potential-difference amendment circuits which added the resistor and the capacitor to this example further is shown in drawing 22 . 2223 or 2224 resistors and a capacitor are added to the electrical-potential-difference amendment circuit of drawing 21 by drawing 22 . By this added resistor and the capacitor, the time constant tau 2 of the operation amplifying circuit 1916 was set up, and the same effectiveness as an example 13 was acquired.

[0127] Although the non-choosing electrical potential difference supplied to the Y driver 12 was mostly changed to real-time so to speak in the [example 15] example 12 - 14 grades, while the same effectiveness as an example 12 is acquired, actuation of an electrical-potential-difference amendment circuit can be carried out to stability, for example by making it the electrical-potential-difference amendment circuit which shows the electrical-potential-difference amendment circuits 1810 and 1840 to drawing 23 in the above-mentioned example 12. That is, as shown in drawing 23 , correction voltage is delayed fixed time within this LP signal cycle by inserting the delay elements 2325, such as a swicthed capacitor circuit and CCD, between inversed amplification 1912 and the operation amplifying circuit 1916, and it adds to a non-choosing electrical potential difference, and since there is non-real-time feedback while the same effectiveness as an example 12 is acquired, even if it supplies this to the Y driver 12, the actuation which the amendment potential circuit oscillated and was stabilized as it is ******** is obtained. It is applicable also in the examples 13 and 14 to insert this delay element, and

the same effectiveness is acquired.
[0128] For every period of [example 16] 1LP, the momentary-current value which flows on the non-choosing electrical potential difference in the power circuit which appears the time of LP1 period initiation or when time amount predetermined [after initiation] passes, or a peak current value may be detected, and the correction voltage according to the detected current value may be added to a non-choosing electrical potential difference (V1 or V4) as fixed correction voltage of the period of this LP period. Drawing 24 explains this. Drawing 24 is drawing showing the configuration of the electrical-potential-difference amendment circuit of drawing 18 . 1911-1915 are the same as the jack per line of drawing 19 . It is the circuit which carries out the sample of the electrical potential difference Vd which 2426 is a sample & hold circuit and outputs LP signal or LP signal from inversed amplification 1913 with the signal which delayed only predetermined time amount corresponding to the transient current, and holds it by drawing 24 on the basis of the output voltage Vc of the operation amplifying circuit 1916. That is, the electrical potential difference which becomes dV=Vd-Vc is held.
[0129] Therefore, since Vc+dV is impressed by the noninverting input of the operation amplifying circuit 1916, the said LP period output of the fixed electrical potential difference which becomes V1 (V4)-dV is carried out.
[0130] Carry out the above actuation and the held electrical potential difference Vd Effective voltage per period of 1LP of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed - since it is proportional to V1 (V4), by setting the amplification factor of inversed amplification 1912 as a suitable value Also when the transient current occurred, it became possible to make equal to an electrical potential difference V1 (V4) effective voltage per period of 1LP of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed, and the same effectiveness as an example 12 was acquired.
[0131] In addition, although this example described the case where the current of the non-choosing electrical potential difference which flows the inside of a power circuit was detected, also when detecting the current of a selection electrical potential difference, and generating correction voltage using an electrical-potential-difference detection electrode further, the same effectiveness is acquired by taking the same circuitry.
[0132] [Example 17] Although amendment of the electrical potential difference on the scan electrode with which the non-choosing electrical potential difference was impressed by changing the correction voltage added to the non-choosing electrical potential difference supplied to the Y driver 12, or electrical-potential-difference actual value was performed in the above-mentioned example 16 Although not stated for details, for example, the current of the non-choosing electrical potential difference of a power circuit as well as an example 16 is detected, and also when only the time amount according to this detected current value adds predetermined correction voltage, the same effectiveness as an example 17 is acquired. Moreover, also when this detects the current of a selection electrical potential difference as well as an example 16, and generating correction voltage using an electrical-potential-difference detection electrode further, the same effectiveness is acquired by taking the same circuitry.
[0133] Although only the liquid crystal panel of the structure where a scan electrode and a signal electrode impress a driver voltage wave from one edge has been described until now [[example 18]], it can be adapted in an above-mentioned example also about the liquid crystal panel of the structure of impressing both edge driver voltage waves about both a scan electrode, and both [either or]. Moreover, in the example which prepares an electrical-potential-difference detection electrode and generates correction voltage, the terminal which takes out the electrical potential difference of an electrical-potential-difference detection electrode may also form the terminal of an electrical-potential-difference detection electrode in not only one edge but a side with the driver voltage terminal of circuitry to which it detects from both ends or a scan electrode, and a signal electrode, and the opposite side. Furthermore, an electrical-potential-difference detection electrode may be formed near the side of **********, and if a display is not hindered by it, it may be formed in a central part.
[0134] It is also easy to compound and use some of the examples 1-17 furthermore, for example, the display unevenness of both warp length and weft length can be canceled by compounding an example 3

and an example 5.
[0135] Although the case of the liquid crystal panel which 1 set of two or more signal electrode and two or more scan electrodes cross mutually on one pair of substrates, and makes a display dot from this examples 1-17 further again was explained Also about the liquid crystal panel with which 2 sets of two or more signal electrodes and 2 sets of two or more scan electrodes cross for each other and each class on one pair of substrates, and make a display dot, and the liquid crystal panel of 2 so-called screen drives The same effectiveness is acquired by adding the correction voltage according to each screen to the supply voltage of X which drives each screen thru/or Y driver. And as an FR signal which supplies the signal which reversed FR signal supplied to X thru/or Y driver which drives one screen to X thru/or Y driver which drives the screen of another side, by supplying,-izing of a part of circuitry can be carried out [****], and circuitry can be simplified at this time. Namely, since the screen of another side uses V5 (0), V1 (4), V0 (5), and V2 (3) when one screen uses V0 (5), V4 (1), V5 (0), and V3 (2) as selection, un-choosing, lighting, and an astigmatism LGT electrical potential difference For example, when one screen uses V1 in the case of the approach of adding correction voltage to a non-choosing electrical potential difference The correction voltage according to the display of one screen is added to V1, and while supplying Y driver which drives this screen, the correction voltage according to the display of the screen of another side can be added to V4, and Y driver which drives this screen can be supplied. Therefore, an amendment potential circuit is sharable.
[0136] [Example 19] Although the electrical-potential-difference equalization drive approach has mainly been explained in addition to an example on these specifications in order to simplify explanation The drive approach that the electrical potential difference impressed to a signal electrode during the period which a selection electrical potential difference impresses to a scan electrode changes (For example, the gradation method of presentation by the so-called Pulse Density Modulation which the time amount which a lighting electrical potential difference and an astigmatism LGT electrical potential difference impress fluctuates), An above-mentioned example has the effectiveness which cancels display unevenness also about the approach of supplying and driving the driver voltage wave which becomes the drive approach, scan electrode, or signal electrode which impresses a selection electrical potential difference to two or more scan electrodes at coincidence from many voltage levels.
[0137] The display quality of electronic equipment can be raised by using any of examples 1-19, or a display for the electronic equipment, for example, a personal computer, which needs a [example 20] display function, a word processor, an electronic notebook, etc.
[0138]
[Effect of the Invention] As stated above, by detecting electrical-potential-difference change or current change of a part with a liquid crystal display system, supposing distortion generated on the electrode of a liquid crystal panel, correction voltage was generated by this and display unevenness has been easily improved by adding this correction voltage to a driver voltage wave. That is, the circuit which calculates a deformation amount became unnecessary from the indicative data, the liquid crystal display which gives an indication high-definition by very simple circuitry could be offered, and the display of the electronic equipment using this display was able to become still more nearly high-definition, and small lightweight-ization was able to be attained. And since correction voltage was generated by this supposing distortion generated on the electrode of a liquid crystal panel by detecting electrical-potential-difference change or current change of a part with a liquid crystal display system, display unevenness could be improved, without asking the drive approach of driving a liquid crystal panel.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 2nd partition of the 6th section
[Publication date] April 27, Heisei 13 (2001. 4.27)

[Publication No.] JP,6-27899,A
[Date of Publication] February 4, Heisei 6 (1994. 2.4)
[Annual volume number] Open patent official report 6-279
[Application number] Japanese Patent Application No. 4-307323
[The 7th edition of International Patent Classification]

G09G 3/36

[FI]

G09G 3/36

[Procedure revision]
[Filing Date] September 16, Heisei 11 (1999. 9.16)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] The name of invention
[Method of Amendment] Modification
[Proposed Amendment]
[Title of the Invention] It is the drive approach of liquid crystal equipment to liquid crystal equipment and an electronic equipment list.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
Liquid crystal equipment characterized by providing a detection means to detect change of the difference of the driver voltage supplied to said scan electrode, and the electrical potential difference

supplied to said scan electrode drive circuit, and an amendment means to supply the correction voltage according to change of said difference which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Claim 2] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
It comes to provide the electrical-potential-difference detection electrode arranged so that said signal electrode or said scan signal electrode may be intersected,
Liquid crystal equipment characterized by providing a detection means to detect the voltage variation generated in said electrical-potential-difference detection electrode, and an amendment means to supply the correction voltage according to said voltage variation which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Claim 3] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
Liquid crystal equipment characterized by providing a detection means to detect change of the current which flows from said scan electrode drive circuit to said said power circuit, and an amendment means to supply the correction voltage according to change of said current which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Claim 4] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
Liquid crystal equipment characterized by providing an amendment means to generate said electrical potential difference which a detection means to detect the electrical potential difference of a part with said liquid crystal equipment or change of a current, and said detection means detected, or the correction voltage according to change of a current.
[Claim 5] Electronic equipment characterized by using the liquid crystal equipment of a publication for either among claim 1 thru/or claim 4.
[Claim 6] In the approach of driving the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
The electrical potential difference of a part with said liquid crystal equipment or change of a current is detected,
The correction voltage according to said change of said detected electrical potential difference or a current is generated,
The drive approach of the liquid crystal equipment characterized by supplying said correction voltage to said scan electrode drive circuit or a signal-electrode drive circuit.
[Procedure amendment 3]
[Document to be Amended] Specification

[Item(s) to be Amended] 0007
[Method of Amendment] Modification
[Proposed Amendment]
[0007]

* NOTICES *

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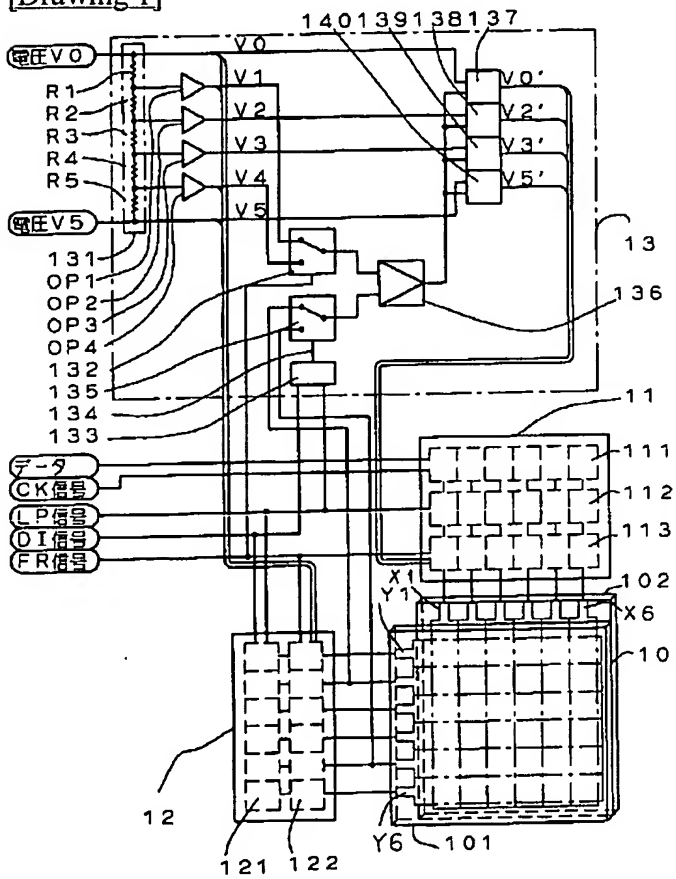
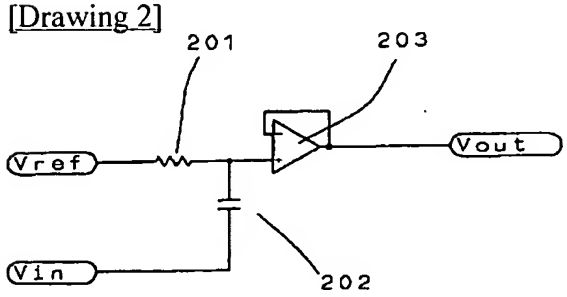
DRAWINGS

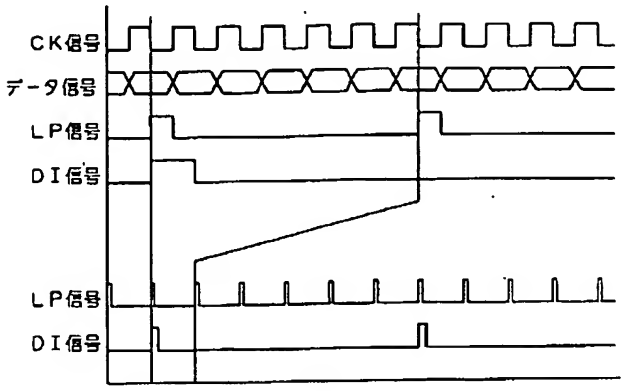
[Drawing 1]



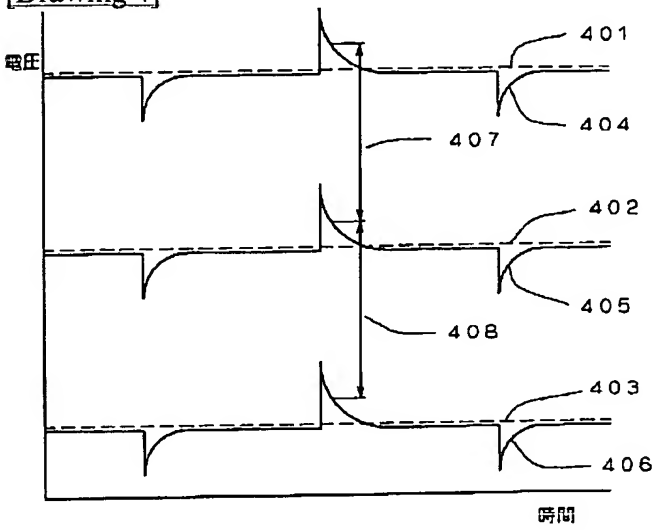
[Drawing 2]



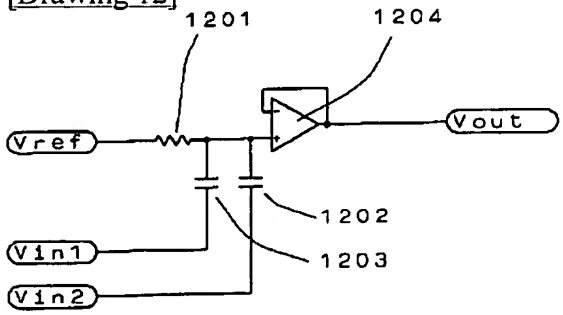
[Drawing 3]



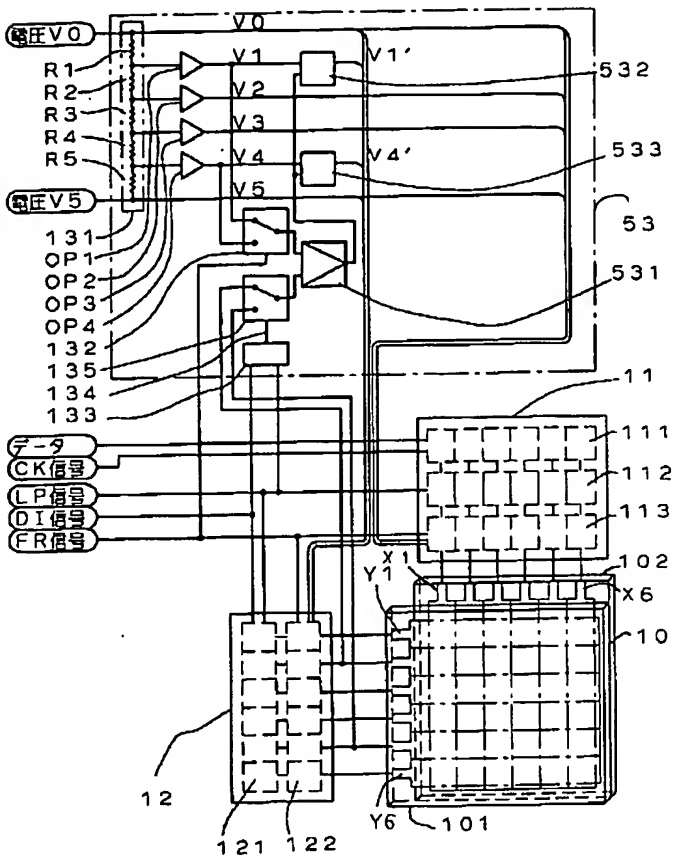
[Drawing 4]



[Drawing 12]



[Drawing 5]


電圧V0
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
132
135
134
133
データ
CK信号
LP信号
DI信号
FR信号
V0
V1
V2
V3
V4
V5
V1'
V4'
532
533
53
531
11
111
112
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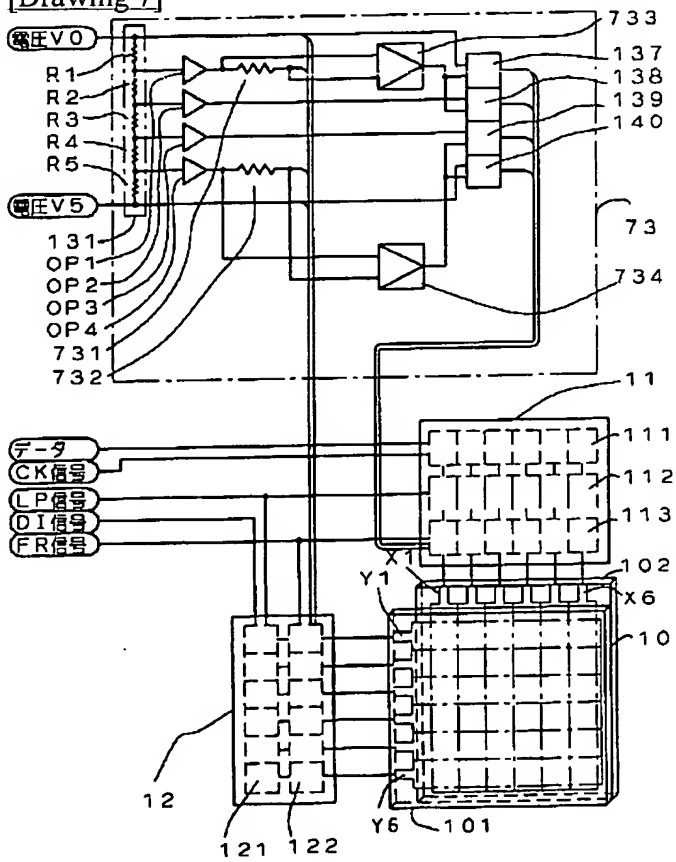
102
X1
Y1
X6
10
12
121
122
Y6
101

[Drawing 7]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R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
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732
データ
CK信号
LP信号
DI信号
FR信号
733
137
138
139
140
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X1
Y1
X6
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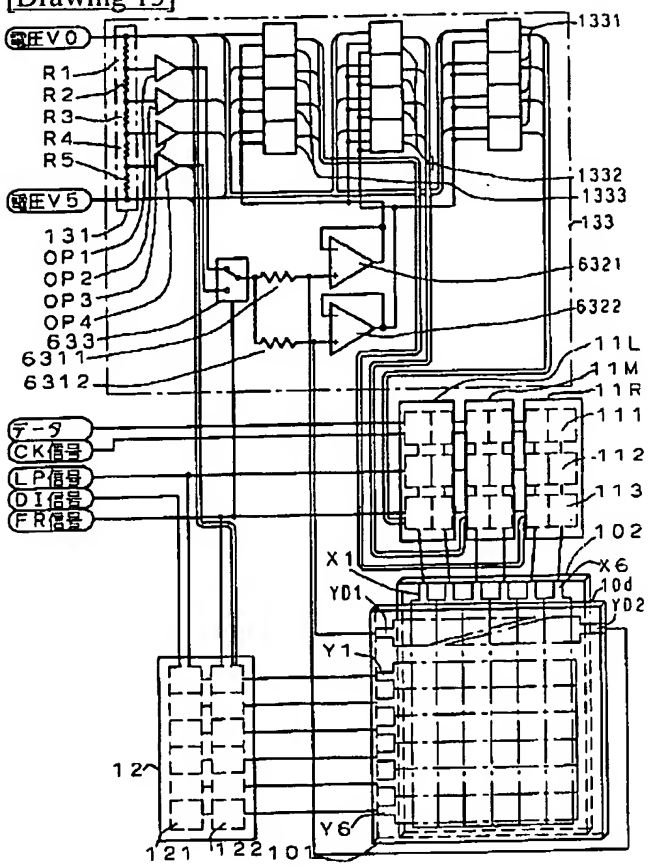
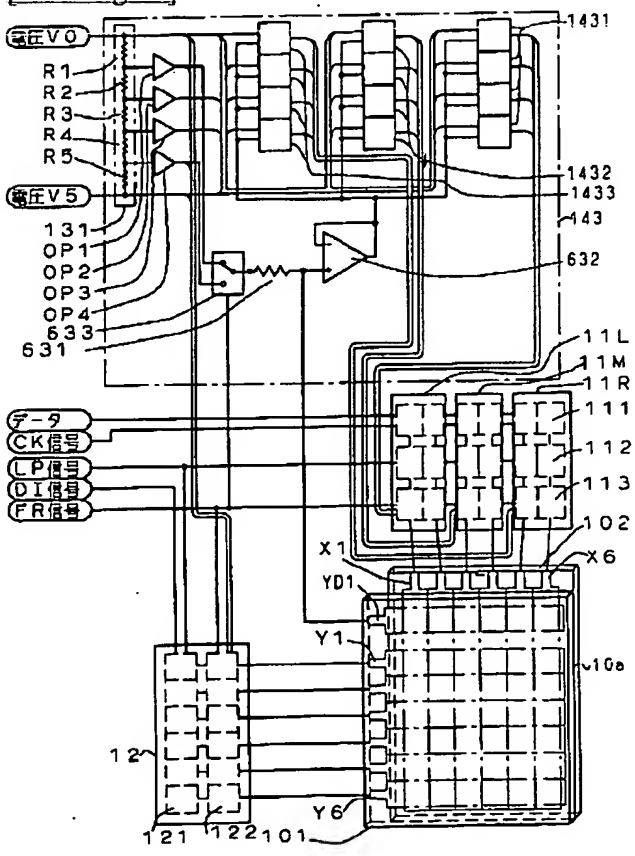
121
122
Y6
101

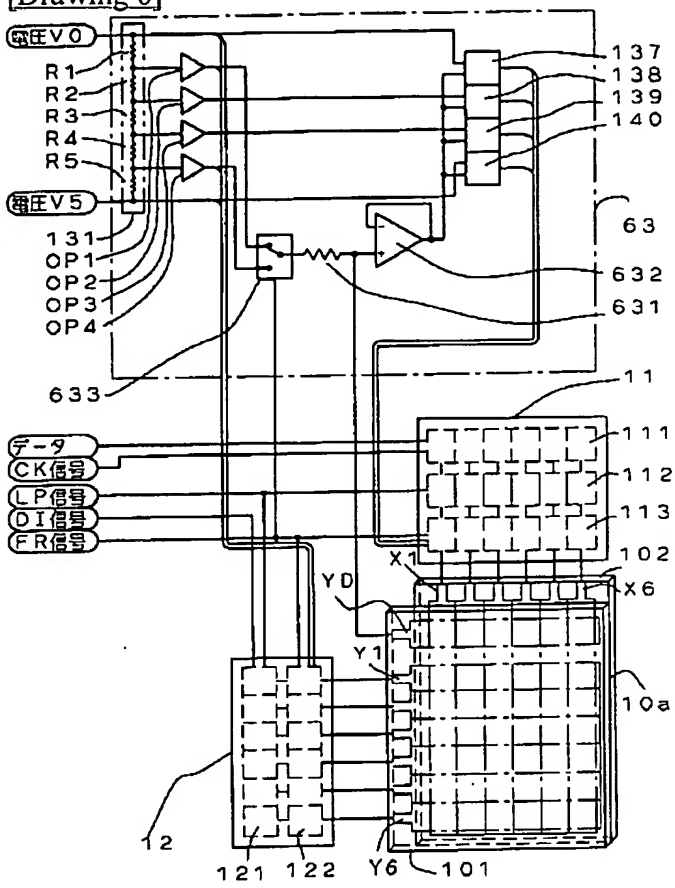
[Drawing 13]



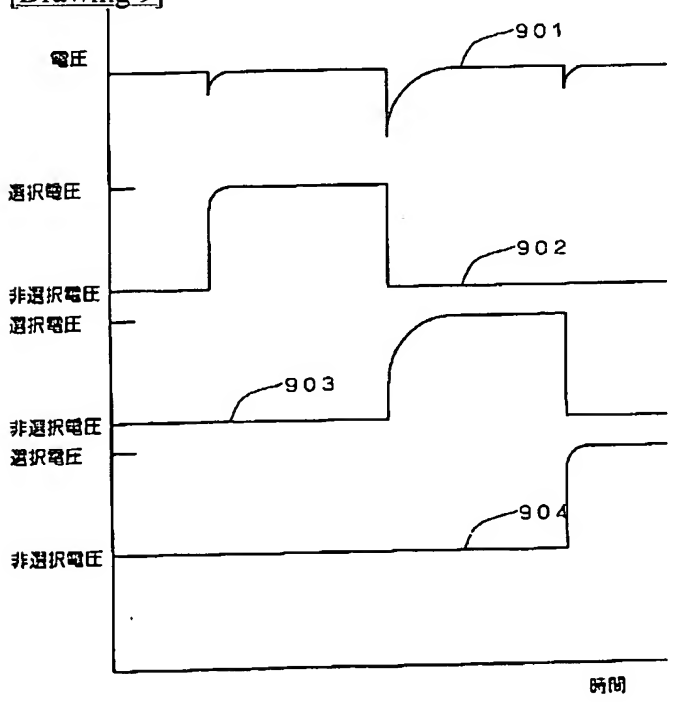
[Drawing 14]



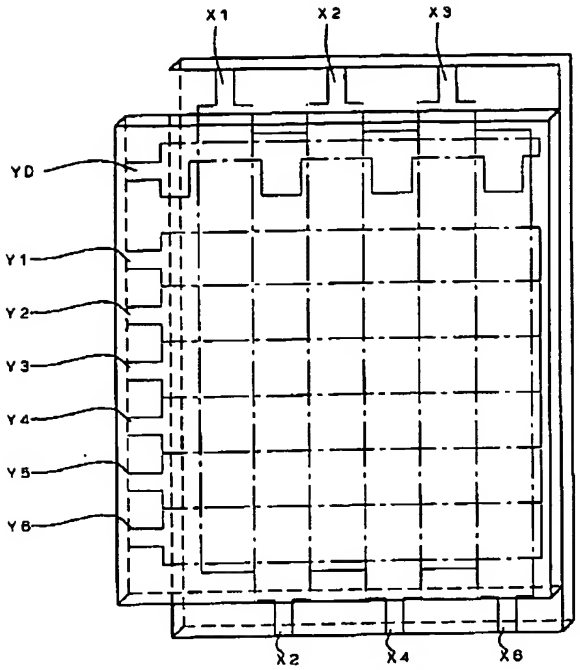
[Drawing 6]



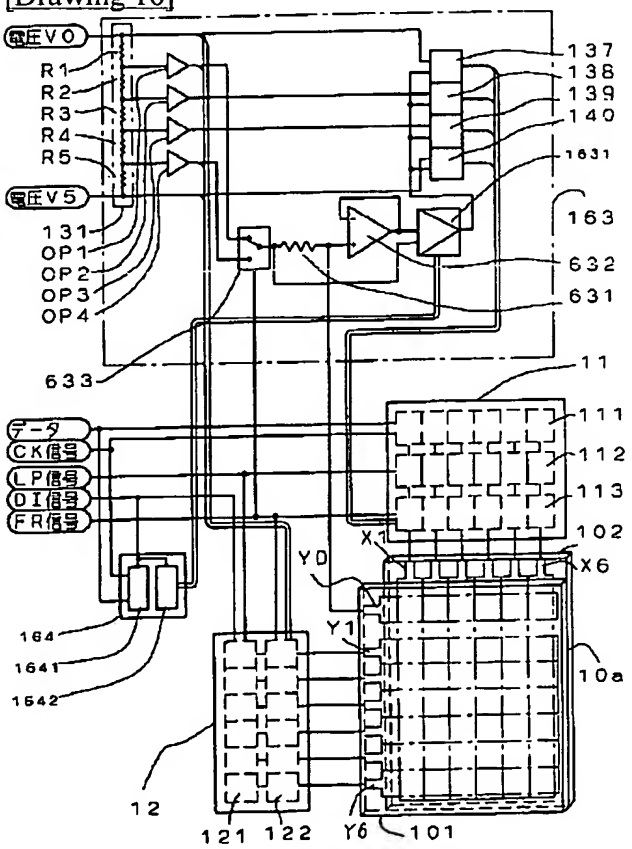
[Drawing 9]



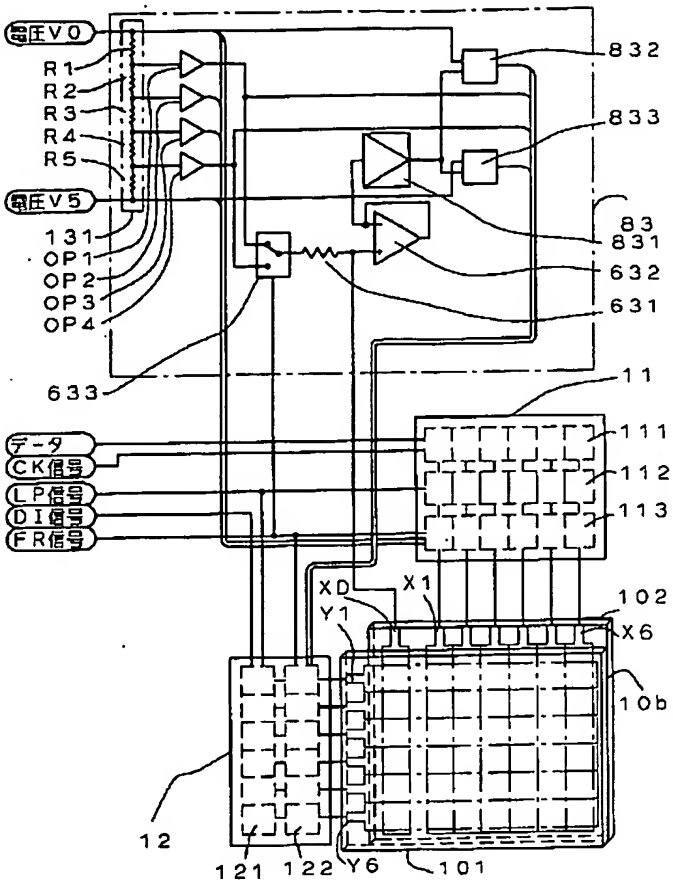
[Drawing 15]



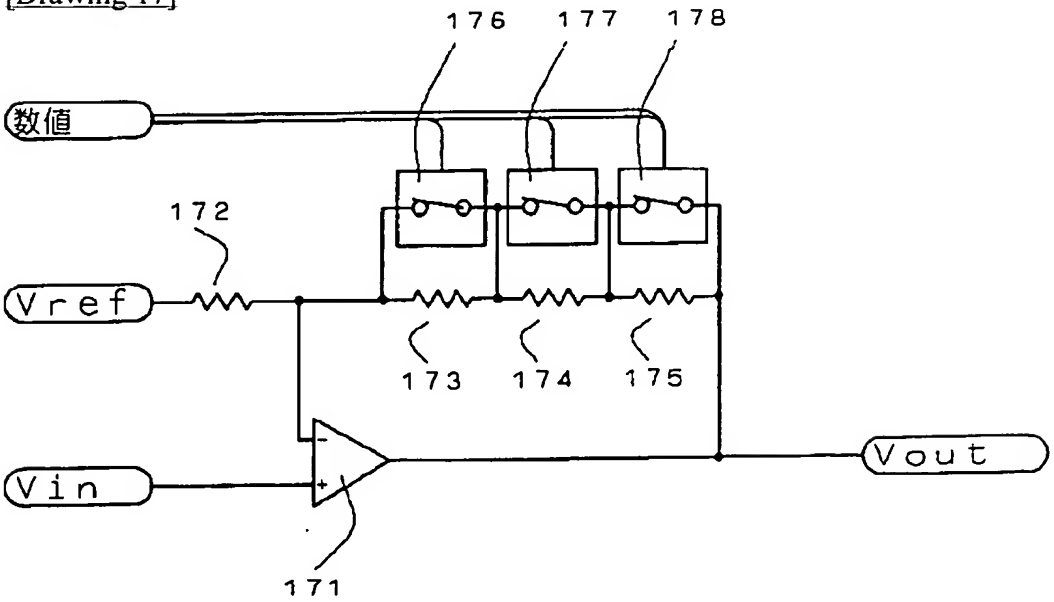
[Drawing 16]



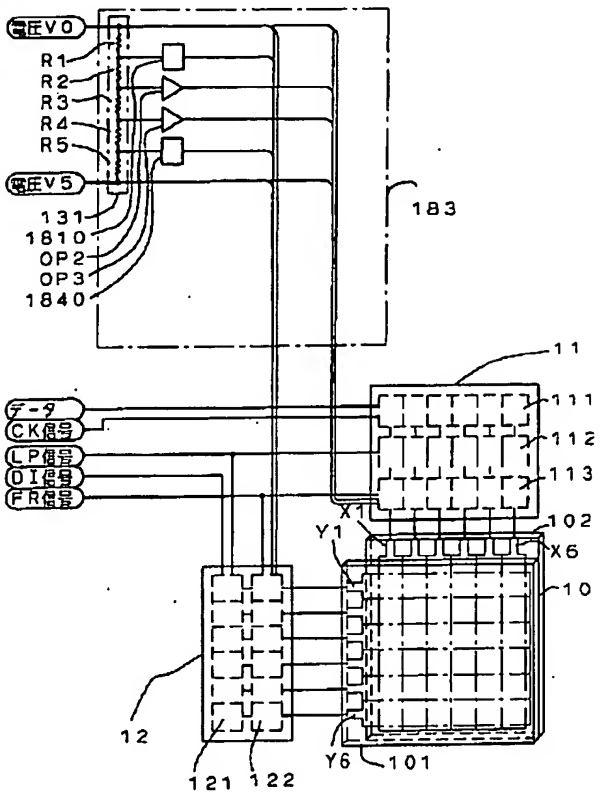
[Drawing 8]



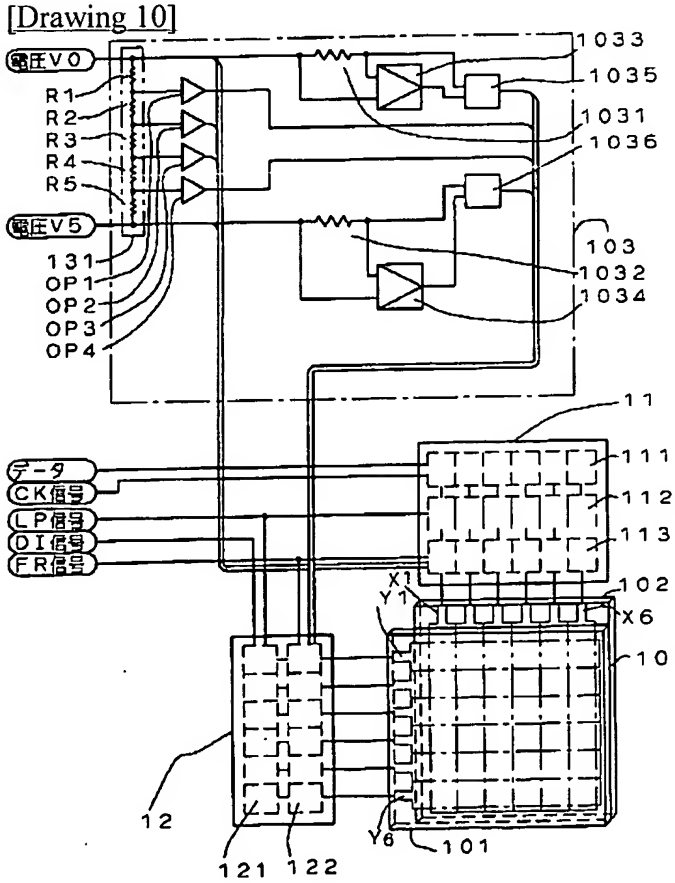
[Drawing 17]



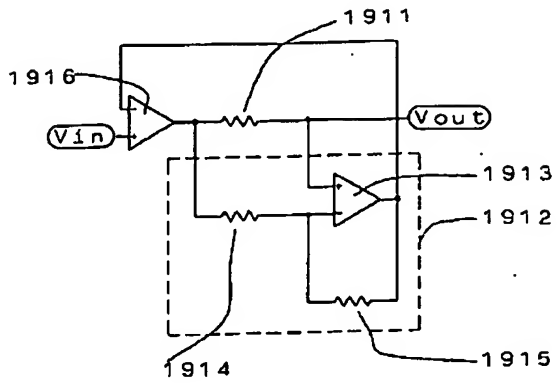
[Drawing 18]



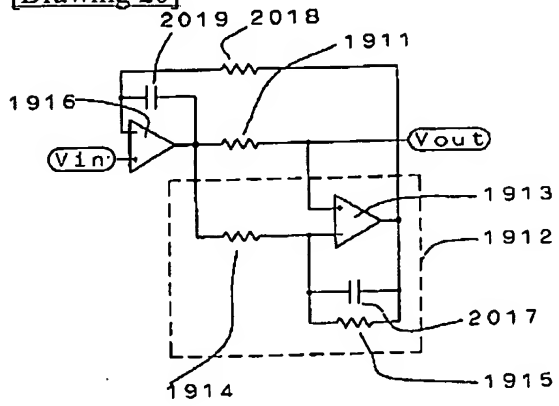
[Drawing 10]



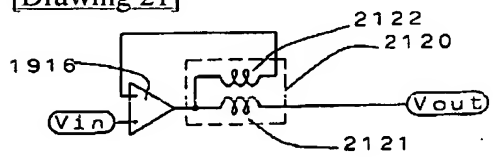
[Drawing 19]



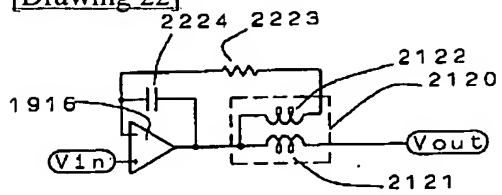
[Drawing 20]



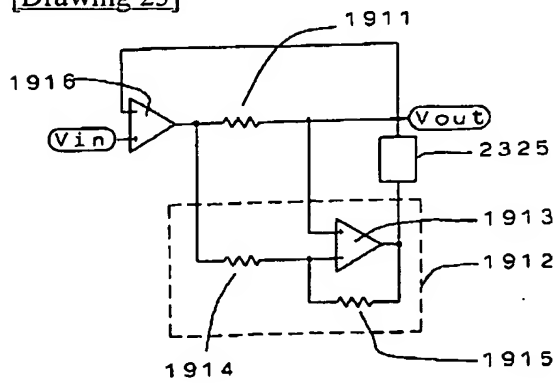
[Drawing 21]



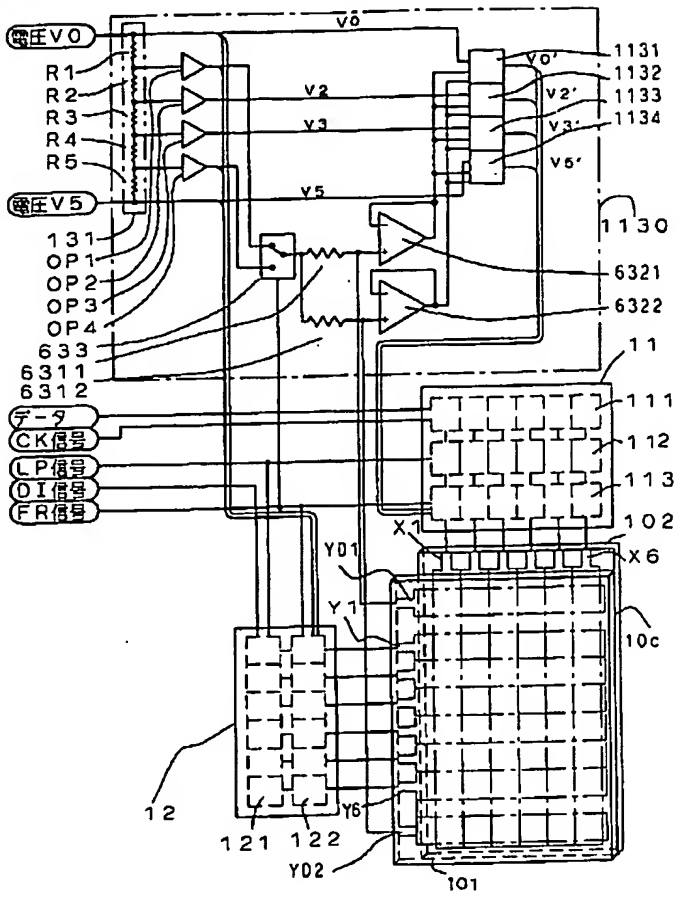
[Drawing 22]



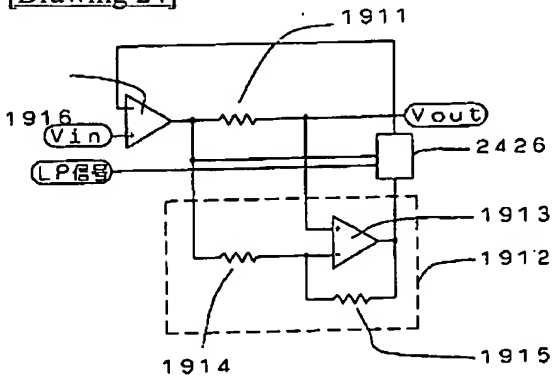
[Drawing 23]



[Drawing 11]



[Drawing 24]



[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 2nd partition of the 6th section
[Publication date] April 27, Heisei 13 (2001. 4.27)

[Publication No.] JP,6-27899,A
[Date of Publication] February 4, Heisei 6 (1994. 2.4)
[Annual volume number] Open patent official report 6-279
[Application number] Japanese Patent Application No. 4-307323
[The 7th edition of International Patent Classification]

G09G 3/36

[FI]

G09G 3/36

[Procedure revision]
[Filing Date] September 16, Heisei 11 (1999. 9.16)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] The name of invention
[Method of Amendment] Modification
[Proposed Amendment]
[Title of the Invention] It is the drive approach of liquid crystal equipment to liquid crystal equipment and an electronic equipment list.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
Liquid crystal equipment characterized by providing a detection means to detect change of the difference of the driver voltage supplied to said scan electrode, and the electrical potential difference

supplied to said scan electrode drive circuit, and an amendment means to supply the correction voltage according to change of said difference which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Claim 2] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
It comes to provide the electrical-potential-difference detection electrode arranged so that said signal electrode or said scan signal electrode may be intersected,
Liquid crystal equipment characterized by providing a detection means to detect the voltage variation generated in said electrical-potential-difference detection electrode, and an amendment means to supply the correction voltage according to said voltage variation which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Claim 3] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
Liquid crystal equipment characterized by providing a detection means to detect change of the current which flows from said scan electrode drive circuit to said said power circuit, and an amendment means to supply the correction voltage according to change of said current which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Claim 4] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
Liquid crystal equipment characterized by providing an amendment means to generate said electrical potential difference which a detection means to detect the electrical potential difference of a part with said liquid crystal equipment or change of a current, and said detection means detected, or the correction voltage according to change of a current.
[Claim 5] Electronic equipment characterized by using the liquid crystal equipment of a publication for either among claim 1 thru/or claim 4.
[Claim 6] In the approach of driving the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
The electrical potential difference of a part with said liquid crystal equipment or change of a current is detected,
The correction voltage according to said change of said detected electrical potential difference or a current is generated,
The drive approach of the liquid crystal equipment characterized by supplying said correction voltage to said scan electrode drive circuit or a signal-electrode drive circuit.
[Procedure amendment 3]
[Document to be Amended] Specification

[Item(s) to be Amended] 0007
[Method of Amendment] Modification
[Proposed Amendment]
[0007]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the liquid crystal equipment of this invention The liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. A detection means to detect change of the difference of the driver voltage supplied to said scan electrode, and the electrical potential difference supplied to said scan electrode drive circuit, And it is characterized by providing an amendment means to supply the correction voltage according to change of said difference which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0008
[Method of Amendment] Modification
[Proposed Amendment]
[0008] Moreover, the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. It comes to provide the electrical-potential-difference detection electrode arranged so that said signal electrode or said scan signal electrode may be intersected. It is characterized by providing a detection means to detect the voltage variation generated in said electrical-potential-difference detection electrode, and an amendment means to supply the correction voltage according to said voltage variation which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0009
[Method of Amendment] Modification
[Proposed Amendment]
[0009] Moreover, the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, and the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. It is characterized by providing a detection means to detect the current which flows from said scan electrode drive circuit to said said power circuit, and an amendment means to supply the electrical potential difference according to change of the current which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0010
[Method of Amendment] Modification
[Proposed Amendment]
[0010] Moreover, the liquid crystal panel arranged so that two or more scan electrodes and two or more

signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. It is characterized by providing an amendment means to generate said electrical potential difference which a detection means to detect the electrical potential difference of a part with said liquid crystal equipment or change of a current, and said detection means detected, or the correction voltage according to change of a current.
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0011
[Method of Amendment] Modification
[Proposed Amendment]
[0011] Moreover, the electronic equipment of this invention is characterized by using the liquid crystal equipment of above-mentioned this invention.
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0012
[Method of Amendment] Modification
[Proposed Amendment]
[0012] Moreover, the liquid crystal panel with which the drive approach of the liquid crystal equipment of this invention has been arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the approach of driving the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. The electrical potential difference of a part with said liquid crystal equipment or change of a current is detected, the correction voltage according to said change of said detected electrical potential difference or a current is generated, and it is characterized by supplying said correction voltage to said scan electrode drive circuit or a signal-electrode drive circuit.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平6－27899

(43)公開日　平成６年(1994)２月４日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ０９Ｇ　3/36		7319－5Ｇ		

審査請求　未請求　請求項の数11(全 20 頁)

(21)出願番号　特願平4－307323

(22)出願日　平成４年(1992)11月17日

(31)優先権主張番号　特願平4－122144
(32)優先日　平４(1992)５月14日
(33)優先権主張国　日本（ＪＰ）
(31)優先権主張番号　特願平4－122145
(32)優先日　平４(1992)５月14日
(33)優先権主張国　日本（ＪＰ）

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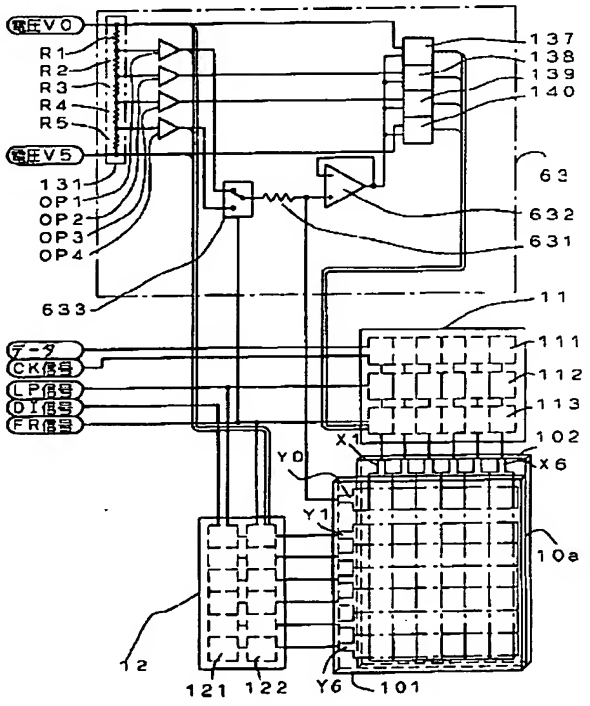
(54)【発明の名称】　液晶表示装置及び電子機器

(57)【要約】
【目的】液晶表示装置の表示むらを軽減する。
【構成】液晶表示装置系の一部の電圧あるいは電流変化を検出し、これによって駆動波形の歪を推定し、これから補正電圧を発生させ、この補正電圧を信号電極あるいは走査電極の駆動電圧波形に付け加える。
【効果】信号電極あるいは走査電極上の駆動波形の歪が相殺され表示むらが軽減する。



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【特許請求の範囲】

【請求項１】液晶層を挟持する一対の基板の一方の基板に複数の走査電極が形成され他方の基板に複数の信号電極が前記走査電極と交差するように形成され該交差部分が表示ドットとなる液晶パネルと、該液晶パネルの前記複数の各走査電極に駆動電圧波形を供給する走査電極駆動回路と、前記複数の各信号電極に駆動電圧波形を供給する信号電極駆動回路と、前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な複数の電圧と前記信号電極駆動回路が前記複数の各信号電極に供給する駆動電圧波形を形成するのに必要な複数の電圧を発生する電源回路と、前記液晶パネルが表示する文字や図形に応じた補正電圧を前記走査電極に印加する前記駆動電圧波形と前記信号電極に印加する前記駆動電圧波形の少なくとも一方に付け加える補正手段を具備する液晶表示装置に於いて、前記補正手段が前記液晶パネルもしくは前記走査電極駆動回路もしくは前記信号電極駆動回路もしくは電源回路の少なくとも一部で発生する電圧、あるいは電流の変化を検出する検出手段を具備し、該検出手段が検出する前記電圧、あるいは電流の変化に応じた大きさの電圧を前記補正電圧とすることを特徴とする液晶表示装置。

【請求項２】請求項１記載の液晶表示装置に於いて、前記検出手段が前記液晶パネルの前記複数の各走査電極の内少なくとも１つ走査電極の駆動電圧波形と前記電源回路が発生する前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な電圧の内少なくとも１つの電圧との差の電圧変化を検出することを特徴とする液晶表示装置。

【請求項３】請求項１記載の液晶表示装置に於いて、前記液晶パネルの前記走査電極が形成されている基板に少なくとも１つ以上の電圧検出電極を複数の前記信号電極の少なくとも一部と交差するように形成し、または前記液晶パネルの前記信号電極が形成されている基板に少なくとも１つ以上の電圧検出電極を複数の前記走査電極の少なくとも一部と交差するように形成し、前記検出手段が前記電圧検出電極に発生する電圧変動を検出することを特徴とする液晶表示装置。

【請求項４】請求項１記載の液晶表示装置に於いて、前記検出手段が、前記電源回路が前記走査電極駆動回路に供給する少なくとも１つの電圧について前記電源回路から前記走査電極駆動回路に流れる電流を検出することを特徴とする液晶表示装置。

【請求項５】請求項２もしくは３もしくは４記載の液晶表示装置に於いて、前記検出手段が検出する電圧あるいは電流の変化が複数の場合に、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の関数を設定し該関数に応じた補正電圧を発生することを特徴とする液晶表示装置。

【請求項６】請求項５記載の液晶表示装置に於いて、前

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記関数が前記複数の変数を平均化する関数であることを特徴とする液晶表示装置。

【請求項７】請求項３記載の液晶表示装置に於いて、前記液晶パネルに形成した前記電圧検出電極が複数の場合に、前記補正手段が前記検出手段がそれぞれの前記電圧検出電極から検出する電圧の変化を複数の変数とする所定の関数を設定し該関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする液晶表示装置。

【請求項８】請求項３記載の液晶表示装置に於いて、前記電圧検出電極が該電圧検出電極と複数の前記信号電極あるいは前記走査電極が各々交差する部分の面積を前記信号電極あるいは前記走査電極によって異ならせてあることを特徴とする液晶表示装置。

【請求項９】請求項５記載の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の複数の関数を設定し該複数の関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする液晶表示装置。

【請求項１０】請求項３記載の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する電圧変化と前記液晶パネルの前記表示ドットの内の点灯しているドット数に応じた補正電圧を発生することを特徴とする液晶表示装置。

【請求項１１】請求項１もしくは２もしくは３もしくは４もしくは５もしくは６もしくは７もしくは８もしくは９もしくは１０記載の液晶表示装置を具備することを特徴とする電子機器。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は液晶表示装置に関するもので、詳しくは表示むらの改善に関するものである。

【０００２】

【従来の技術】液晶表示装置の液晶パネルは、液晶パネルを構成する走査電極及び信号電極に液晶表示装置内の電源回路で発生する異なった電圧で構成された電圧波形（以後、駆動電圧波形と言う。）を供給することで駆動、表示が行われる。そして、液晶パネルが表示する内容に応じてこれらの駆動電圧波形は変化する。

【０００３】ここで、液晶パネルが容量性の負荷であり走査電極及び信号電極が電気抵抗を持っていることから走査電極及び信号電極に印加する電圧波形によって、走査電極及び信号電極に印加する電圧波形に歪が生じ、こ

れによって表示にむらが発生すると言った問題があった。

【０００４】この問題について、筆者等が出願した特開平２－８９号公報等で提示したような駆動電圧波形に補正電圧を付け加えて歪を矯正する方法が知られていた。

【０００５】

【発明が解決しようとする課題】しかし、特開平２－８９号公報等で提示した方法は表示むらを著しく低減できるが、これを行う際に予め補正量を計算するための回路を必要としていたため、液晶表示装置が複雑なものになり小型軽量化が難しくなっていた。

【０００６】本発明はかかる問題を鑑みてなされたものであり、走査電極及び信号電極に印加する電圧波形に生じる歪は走査電極上の電圧に対する信号電極上の電圧の変化の総和で規定されることに着目し、さらにこの電圧の変化の総和に応じた電流が電源回路に流れることから、これらの電圧の変化または電流の変化を監視することによって液晶パネル内での走査電極または信号電極に発生する歪を推定して、この歪を相殺する補正電圧を駆動電圧波形に付け加えることによって、表示むらを解消しようとするもので、その目的は表示むらを簡素な回路構成によって解消し表示品位の高い表示装置及び見やすい表示装置を搭載した小型軽量化した電子機器を提供することにある。

【０００７】

【課題を解決する為の手段】第１の本発明の液晶表示装置は、液晶層を挟持する一対の基板の一方の基板に複数の走査電極が形成され他方の基板に複数の信号電極が前記走査電極と交差するように形成され該交差部分が表示ドットとなる液晶パネルと、該液晶パネルの前記複数の各走査電極に駆動電圧波形を供給する走査電極駆動回路と、前記複数の各信号電極に駆動電圧波形を供給する信号電極駆動回路と、前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な複数の電圧と前記信号電極駆動回路が前記複数の各信号電極に供給する駆動電圧波形を形成するのに必要な複数の電圧を発生する電源回路と、前記液晶パネルが表示する文字や図形に応じた補正電圧を前記走査電極に印加する前記駆動電圧波形と前記信号電極に印加する前記駆動電圧波形の少なくとも一方に付け加える補正手段を具備する液晶表示装置に於いて、前記補正手段が前記液晶パネルもしくは前記走査電極駆動回路もしくは前記信号電極駆動回路もしくは電源回路の少なくとも一部で発生する電圧、あるいは電流の変化を検出する検出手段を具備し、該検出手段が検出する前記電圧、あるいは電流の変化に応じた大きさの電圧を前記補正電圧とすることを特徴する。

【０００８】第２の本発明の液晶表示装置は、第１の本発明の液晶表示装置に於いて、前記検出手段が前記液晶パネルの前記複数の各走査電極の内少なくとも１つ走査

電極の駆動電圧波形と前記電源回路が発生する前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な電圧の内少なくとも１つの電圧との差の電圧変化を検出することを特徴とする。

【０００９】第３の本発明の液晶表示装置は、第１の本発明の液晶表示装置に於いて、前記液晶パネルの前記走査電極が形成されている基板に少なくとも１つ以上の電圧検出電極を複数の前記信号電極の少なくとも一部と交差するように形成し、または前記液晶パネルの前記信号電極が形成されている基板に少なくとも１つ以上の電圧検出電極を複数の前記走査電極の少なくとも一部と交差するように形成し、前記検出手段が前記電圧検出電極に発生する電圧変動を検出することを特徴とする。

【００１０】第４の本発明の液晶表示装置は、第１の本発明の液晶表示装置に於いて、前記検出手段が、前記電源回路が前記走査電極駆動回路に供給する少なくとも１つの電圧について前記電源回路から前記走査電極駆動回路に流れる電流を検出することを特徴とする。

【００１１】第５の本発明の液晶表示装置は、第２もしくは３もしくは４の本発明の液晶表示装置に於いて、前記検出手段が検出する電圧あるいは電流の変化が複数の場合に、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の関数を設定し該関数に応じた補正電圧を発生することを特徴とする。

【００１２】第６の本発明の液晶表示装置は、第５の本発明の液晶表示装置に於いて、前記関数が前記複数の変数を平均化する関数であることを特徴とする。

【００１３】第７の本発明の液晶表示装置は、第３の本発明の液晶表示装置に於いて、前記液晶パネルに形成した前記電圧検出電極が複数の場合に、前記補正手段が前記検出手段がそれぞれの前記電圧検出電極から検出する電圧の変化を複数の変数とする所定の関数を設定し該関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする。

【００１４】第８の本発明の液晶表示装置は、第３の本発明の液晶表示装置に於いて、前記電圧検出電極が該電圧検出電極と複数の前記信号電極あるいは前記走査電極が各々交差する部分の面積を前記信号電極あるいは前記走査電極によって異ならせてあることを特徴とする。

【００１５】第９の本発明の液晶表示装置は、第５の本発明の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の複数の関数を設定し該複数の関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶

パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする。

【００１６】第１０の本発明の液晶表示装置は、第３の本発明の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する電圧変化と前記液晶パネルの前記表示ドットの内の点灯しているドット数に応じた補正電圧を発生することを特徴とする。

【００１７】第１１の本発明の電子機器は、第１もしくは２もしくは３もしくは４もしくは５もしくは６もしくは７もしくは８もしくは９もしくは１０の本発明の液晶表示装置を具備することを特徴とする。

【００１８】

【実施例】

［実施例１］本発明の駆動方法を実施例を用いてさらに詳しく説明する。ここで、まず液晶パネルの信号電極の配列方向に発生する表示むらを解消する場合について説明する。

【００１９】図１は本実施例の構成を示す図である。図で、１０は液晶パネルで液晶層（図示せず。）を挟持する一対の基板１０１、１０２からなり一方の基板１０１には走査電極Ｙ１～Ｙ６、他方の基板１０２には信号電極Ｘ１～Ｘ６が形成されている。ここで、走査電極Ｙ１～Ｙ６、信号電極Ｘ１～Ｘ６はそれぞれ６本と少ないがこれは説明を簡単にするためで、通常これよりはるかに多い。

【００２０】１１はＸドライバであり、１１１～１１３はその内部構成要素でそれぞれ６ビットのシフト・レジスタ回路、６ビットのラッチ回路、６ビットの４回路１接点のアナログ・スイッチ回路である。なお、ビット数は液晶パネル１０の信号電極の数である。

【００２１】１２はＹドライバであり、１２１、１２２はその内部構成要素でそれぞれ６ビットのシフト・レジスタ回路、６ビットの４回路１接点のアナログ・スイッチ回路である。なお、ビット数は液晶パネル１０の走査電極の数である。そして、データ信号、ＣＫ信号、ＬＰ信号、ＤＩ信号、ＦＲ信号が外部より取り込まれる。以上の構成は従来技術の構成と同じである。

【００２２】１３は電源回路で、液晶パネルを駆動するのに必要な６レベルの電圧を、電圧Ｖ０－電圧Ｖ１＝電圧Ｖ１－電圧Ｖ２＝電圧Ｖ３－電圧Ｖ４＝電圧Ｖ４－電圧Ｖ５（＝Ｖとおく。）で、電圧Ｖ０－電圧Ｖ５＝ｎ・Ｖ（ｎは正数で、通常１０前後。）となる関係を持つ電圧Ｖ０～Ｖ５を発生させる場合に、１３１は電圧分割回路で、５本の抵抗器Ｒ１、Ｒ２、Ｒ３、Ｒ４、Ｒ５からなり、抵抗器Ｒ１、Ｒ２、Ｒ４、Ｒ５はＲなる抵抗値を持ち、Ｒ３は（ｎ－４）Ｒなる抵抗値を持つ。この電圧分割回路１３１の両端に、即ち図で抵抗器Ｒ１の上と抵抗器Ｒ５の下にそれぞれ電圧Ｖ０、電圧Ｖ５を印加すると各抵抗器Ｒ１とＲ２、Ｒ２とＲ３、Ｒ３とＲ４、Ｒ４とＲ５間にそれぞれ電圧Ｖ１、Ｖ２、Ｖ３、Ｖ４が分割

されて発生する。

【００２３】ＯＰ１～ＯＰ４は電圧分割回路１１が発生した電圧Ｖ１、Ｖ２、Ｖ３、Ｖ４をインピーダンスを下げて出力するボルテージ・ホロワ回路である。このボルテージ・ホロワ回路ＯＰ１～ＯＰ４は、一般的には演算増幅回路によって構成されている。

【００２４】１３２は基準電圧切り替えスイッチで、ＦＲ信号に応じて電圧Ｖ１と電圧Ｖ４のいずれかを切り替えて出力するスイッチである。

【００２５】１３３は入力電圧切り替え制御回路で、Ｙドライバが走査電極Ｙ１からＹ３のいずれかに選択電圧を出力している間に”０”を、走査電極Ｙ４からＹ６のいずれかに選択電圧を出力している間に”１”となるスイッチ制御信号１３４を出力する回路である。この回路はＬＰ信号をクロック信号、ＤＩ信号をリセット信号とした計数回路とこの計数回路の結果の大小を比較する比較回路等で容易に形成することが出来るので、特に図示して説明することは省略する。

【００２６】１３５は入力電圧切り替えスイッチで、スイッチ制御信号１３４が”１”の時にＹドライバ１２が走査電極Ｙ２に出力する電圧を、”０”の時にＹ５に出力する電圧波形を選択して出力する。

【００２７】１３６は差動増幅回路で、基準電圧切り替えスイッチ２１と入力電圧切り替えスイッチから出力された電圧の差を出力する。

【００２８】１３７～１４０は電圧加算回路で、それぞれ外部から供給される電圧及びボルテージ・ホロワ回路ＯＰ２、ＯＰ３が出力する電圧Ｖ０、Ｖ２、Ｖ３、Ｖ５に差動増幅回路１３６が出力する電圧を加算した電圧をそれぞれ電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ５’として出力する。ここで電圧加算回路１３７～１４０の具体的な一構成例を図２に示す。図で端子Ｖｒｅｆは基準電圧を入力する端子で図１の電圧Ｖ０、Ｖ２、Ｖ３、Ｖ５のいずれかが入力する。図２で端子Ｖｉｎは差動増幅回路１３６の出力する電圧を入力する。２０１は抵抗器、２０２はコンデンサで微分回路を形成し、２０３は演算増幅回路によるボルテージ・ホロワ回路である。端子Ｖｏｕｔはボルテージ・ホロワ回路２０３の出力で図１の電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ５’と対応する。ここで、図２で端子Ｖｉｎに入力する差動増幅回路１３６の出力する電圧はほぼ微分波形に近いのでこの電圧を抵抗２０１とコンデンサ２０２からなる微分回路の端子Ｖｉｎに接続することによって、近似的に端子Ｖｒｅｆの電圧に端子Ｖｉｎの電圧を加えた電圧をボルテージ・ホロワ回路２０３から出力することが出来る。

【００２９】そして、図１で電圧Ｖ０、Ｖ１、Ｖ４、Ｖ５はＹドライバ１２に供給され、電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ５’はＸドライバ１１に供給される。ここで、Ｙドライバ１２に供給する電圧Ｖ５、Ｖ１及びＸドライバ１１に供給する電圧Ｖ０’、Ｖ２’をそれぞれ第

１の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧と呼び、電圧Ｖ０、Ｖ４、Ｖ５’、Ｖ３’をそれぞれ第２の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧と呼ぶ。

【００３０】以上の構成となっている。なお、各回路間の接続については図により明確なので説明を省略する。そして図３に示すように、データ信号、ＣＫ信号、ＬＰ信号、ＤＩ信号が外部から供給される。

【００３１】ここで、動作を説明する。

【００３２】まず、Ｘドライバ１１は図３に示すＣＫ信号に同期して表示内容を決めるデータ信号をシフト・レジスタ回路１１１に順次取り込み、シフトする。そして、シフト・レジスタ回路１１１に液晶パネル１０の信号電極数と同じ数だけデータを取り込むと、図３に示すＬＰ信号に同期してシフト・レジスタ回路１１１の各ビットの内容がラッチ回路１１２の各ビットに取り込まれる。レベル・シフタ回路１１３はラッチ回路１１２に取り込んだ内容とＦＲ信号１５に応じた電圧を出力する。即ち、ラッチ回路１１２に取り込んだ各ビットの内容が点灯を示す（以後、”１”とする。）場合には点灯電圧を出力し、内容が非点灯を示す（以後、”０”とする。）場合には非点灯電圧を出力する。そして、ＦＲ信号が第１の電圧群を選択することを示す（以後、”０”とする。）場合については第１の電圧群を出力し、ＦＲ信号が第２の電圧群を選択することを示す（以後、”１”とする。）場合については第２の電圧群を出力する。

【００３３】Ｙドライバ１２はＬＰ信号に同期して選択する走査電極を決める図４に示すＤＩ信号をシフト・レジスタ回路１２１に順次取り込み、シフトする。レベル・シフタ回路１２２はラッチ回路１２１に取り込んだ内容とＦＲＩ信号１５に応じた電圧を出力する。即ち、ラッチ回路１１２に取り込んだ各ビットの内容が選択を示す場合には選択電圧を出力し、内容が非選択を示す場合には非選択電圧を出力する。そして、ＦＲ信号１５が”０”の場合については第１の電圧群を出力し、ＦＲ信号が”１”の場合については第２の電圧群を出力する。

【００３４】ここで、入力電圧切り替え制御回路１３３は入力電圧切り替えスイッチを、選択電圧が走査電極Ｙ１からＹ３に印加する期間では、Ｙドライバ１２が走査電極Ｙ５に出力する電圧を差動増幅回路１３６に出力し、選択電圧が走査電極Ｙ４からＹ６に印加する期間では、Ｙドライバ１２が走査電極Ｙ２に出力する電圧を差動増幅回路１３６に出力する。よって、常にＦＲ信号に応じて電圧Ｖ１とＶ４が切り替わる電圧波形に歪が重畳された電圧を１３６に出力する。

【００３５】この時、１３２は基準電圧切り替えスイッチはＦＲ信号に応じて電圧Ｖ１とＶ４のいずれかを差動増幅回路１３６に出力する。

【００３６】従って、差動増幅回路１３６はＹドライバ

１２が走査電極Ｙ２もしくはＹ５に出力する電圧波形の歪分のみが出力される。

【００３７】この歪分を電圧加算回路１３７～１４０で、電圧Ｖ０、Ｖ２、Ｖ３、Ｖ４に加算して電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ４’としてＸドライバ１１に出力する。

【００３８】以上の動作を行う。

【００３９】従って、非選択電圧（Ｖ１またはＶ４）の印加する走査電極上の電圧に歪（これをＶｅとする。）が発生すると、走査電極上の電圧はＶｃ＋Ｖｅとなる。この時、信号電極上の電圧は電圧Ｖ０、Ｖ１またはＶ３、Ｖ５にＶｅを加えた電圧Ｖ０’、Ｖ２’またはＶ３’、Ｖ５’になる。従って、走査電極と信号電極の電圧差は、Ｖ０’－Ｖ１＝（Ｖ０＋Ｖｅ）－（Ｖ１＋Ｖｅ）＝Ｖ

Ｖ１－Ｖ２’＝（Ｖ１＋Ｖｅ）－（Ｖ２＋Ｖｅ）＝Ｖ

Ｖ３’－Ｖ４＝（Ｖ３＋Ｖｅ）－（Ｖ４＋Ｖｅ）＝Ｖ

Ｖ４－Ｖ５’＝（Ｖ４＋Ｖｅ）－（Ｖ５＋Ｖｅ）＝Ｖ

となって、歪の大きさ向きの如何にかかわらず常に差は一定となる。よって、液晶パネル１０の各ドットに印加する実効電圧に差異が無くなって表示むらが無くなる。これを図４に示す。図４は液晶パネル１０がある表示を行った時の電圧Ｖ０～電圧Ｖ２及び電圧Ｖ０’～Ｖ２’及び走査電極Ｙ２ないしＹ５に出力するＹドライバ１２の出力波形の一部分を示す図である。

【００４０】図で破線の４０１～４０２は電圧Ｖ０～Ｖ２を示し、実線の４０４、４０６は電圧Ｖ０’、Ｖ２’を示し、実線の４０５は走査電極Ｙ２ないしＹ５に出力するＹドライバ１２の出力波形を示す。そして、４０７、４０８はそれぞれ電圧Ｖ０’、Ｖ２’とＹドライバ１２の出力波形４０５の電圧差を示す。なお、４０１～４０３は見やすいように少しずらして表示してある。ここで、Ｙドライバ１２の出力波形４０５が歪んで、電圧変動が発生するとこれに追従して４０４と４０６即ち電圧Ｖ０’とＶ１’も電圧が変動する。これによって、電圧差４０７、４０８は歪によらずに常に一定となる。ここでは、第１の電圧群について説明したが、第２の電圧群についても同様となる。

【００４１】Ｙドライバ１２の出力する電圧波形の歪分をＸドライバ１１に供給する電圧に単に付け加えたが、Ｙドライバ１２の出力する電圧波形の歪より液晶パネル１０の内部の方がより大きく歪むのでこの分を考慮してＸドライバ１１に供給する電圧に付け加える電圧を大きめにしても良い。これは差動増幅回路１３６の利得を適当な値に設定することによって容易に設定出来る。そして、この場合には検出した歪に対して必ずしも線形に大きくする必要はない。

【００４２】なお参照する走査電極をここではＹ２とＹ５としたが、勿論これに限定するものはなく、いずれの場所の走査電極についてでも良い。また、複数の走査電

極についての歪を平均化して用いても良い。

【００４３】以上述べたように走査電極上の電圧変動を検出して信号電極上の電圧もこれに対応して変動させることによって、容易で簡素に表示むらを解消することが出来た。

【００４４】［実施例２］実施例１では、信号電極の駆動電圧波形に補正電圧を付け加える方法を示したが、走査電極の駆動電圧波形に補正電圧を付け加えることも容易で同様の効果を得られる。この例を説明する。図５は本実施例の構成の一例を示す図である。

【００４５】図で、５３が電源回路で、電源回路５３内の５３１～５３３以外は図１と同じもので同じ動作をするので同番号を付して説明を省略する。

【００４６】５３１は差動増幅回路で、基準電圧切り替えスイッチ２１と入力電圧切り替えスイッチから出力された電圧の差を極性を反転して出力する。

【００４７】５３２と５３３は図１の電圧加算回路１３７～１４０と同じ回路構成を持つ電圧加算回路で、ボルテージ・ホロワ回路ＯＰ１、ＯＰ４が出力する電圧Ｖ１、Ｖ４に差動増幅回路５３１が出力する電圧を加算した電圧をそれぞれ電圧Ｖ１’、Ｖ２’として出力する。

【００４８】そして、図１で電圧Ｖ０、Ｖ１’、Ｖ４’、Ｖ５はＹドライバ１２に供給され、電圧Ｖ０、Ｖ２、Ｖ３、Ｖ５はＸドライバ１１に供給される。ここで、Ｙドライバ１２に供給する電圧Ｖ５、Ｖ１’及びＸドライバ１１に供給する電圧Ｖ０、Ｖ２がそれぞれ第１の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧となり、電圧Ｖ０、Ｖ４’、Ｖ５、Ｖ３がそれぞれ第２の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧となる。

【００４９】以上の構成となっているので、非選択電圧（Ｖ１またはＶ４）の印加する走査電極上の電圧に歪（これをＶｅとする。）が発生しようとすると、即ち走査電極上の電圧がＶｃ＋Ｖｅとなろうとする時、電圧加算器５３２、５３３は－Ｖｅの電圧を電圧Ｖ１またはＶ４に加えるので発生しようとする歪がほぼ相殺される。従って、走査電極上の非選択電圧には歪が殆ど無くなって、表示むらが無くなる。

【００５０】Ｙドライバ１２の出力する電圧波形の歪より液晶パネル１０の内部の方がより大きく歪むのでこの分を考慮してＹドライバ１２に供給する電圧に付け加える補正電圧を大きめにしても良い。これは差動増幅回路５３１の利得を適当な値に設定することによって容易に設定出来る。そして、この場合には検出した歪に対して必ずしも線形に大きくする必要はない。

【００５１】以上述べたように走査電極上の電圧変動を検出して、走査電極上の電圧をこれに対応して変動させることでも、表示むらを解消することが出来た。

【００５２】また、実施例１と実施例２を組み合わせて信号電極及び走査電極の駆動電圧波形の両方に補正電圧を加えても同様の効果がある。

【００５３】［実施例３］他の実施例を示す。実施例１、２では特定の走査電極に出力するＹドライバの出力波形の歪でＸドライバあるいはＹドライバに供給する電圧を変化させることによって表示むらを解消した。ここで、筆者が出願した特開平２－８９号公報で詳しく説明してあるが、簡単に言えば各信号電極の走査電極に対する電圧の変化の総和で、Ｙドライバの出力波形ないし走査電極上の電圧波形の歪が規定されている。従って、液晶パネルの走査電極が形成されている基板上に電圧検出電極を形成し、この電圧検出電極を信号電極と液晶層によって容量結合させ、信号電極の電圧変化の総和を検出し、この結果より、走査電極上の歪を推定してＸドライバに供給する電圧を変化させてもよい。

【００５４】これを、図６を用いてさらに詳しく説明する。図６はこの実施例の構成を示す。図で液晶パネル１０ａと電源回路６３以外は図１の構成と同じであり説明を省略する。

【００５５】図６で液晶パネル１０ａは図１の液晶パネル１０の基板１０１上に新たに電圧検出電極ＹＤを付け加えたものである。電圧検出電極ＹＤは図に示すように信号電極Ｘ１～Ｘ６の全てに対向するように設けてある。ここで、信号電極Ｘ１からＸ６上の電圧変化による走査電極上に発生させる影響が各信号電極毎に異なる場合には、電圧検出電極ＹＤの幅は一様でなくとも良く、例えば左から右になるに従って広くなるように形成しても良い。

【００５６】図６で６３は電源回路で、６３１～６３３以外の構成要素は図１の電源回路１３と同じなので説明を省略する。６３１は抵抗器で液晶パネル１０ａ上に設けた電圧検出電極ＹＤとこれに対向する信号電極Ｘ１～Ｘ６からなるコンデンサとで微分回路を形成する。６３２はボルテージ・ホロワ回路で電圧検出電極ＹＤに発生する電圧をインピーダンスを下げて出力する。このボルテージ・ホロワ回路６３２は必ずしも１倍の増幅率で無く任意倍の非反転増幅器であっても良い。６３３はスイッチ回路で抵抗器６３１の一端に加える電圧（以後、基準電圧と言う）を電圧Ｖ１と電圧Ｖ４のいずれかに切り替えるスイッチである。即ち、Ｙドライバが非選択電圧として電圧Ｖ１を用いている時には電圧Ｖ１を、電圧Ｖ４を用いている時は電圧Ｖ４を抵抗器６３１の一端に加える。以上の構成となっているので、ボルテージ・ホロワ回路６３２は各信号電極Ｘ１～６の電圧の変化の総和に応じた電圧変動を発生するから、この電圧変動を用いて電圧加算回路１３７～１４０で電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ５’を発生する。

【００５７】以上の構成と動作をする。

【００５８】従って、実施例１と同様の動作をするから同様の効果を得るとともに、駆動方法が電圧平均化法でない場合、例えば特開昭６０－２４７２２４号公報等で

提示されている２値の電圧で異なった形状の電圧波形が走査電極に印加させて駆動する方法で液晶パネルを駆動した場合に、各走査電極の電圧波形が個々に異なった形状をしている為に、走査電極走査電極の歪を直接検出することが難しいので、電圧検出電極によって走査電極上の歪を推定するこの実施例の方法が有効である。

【００５９】なお、スイッチ回路６３１は、Ｙドライバ１２が用いる非選択電圧が電圧Ｖ１とＶ４の２つの電圧を用いることによって必要となっている。即ち、Ｙドライバ１２の出力する非選択電圧に対する信号電極上の電圧変化の総和を検出する際にＹドライバ１２が出力する非選択電圧が電圧Ｖ１(４)からＶ４(１)に切り替わる時（ＦＲ信号が変化する時）に抵抗器６３１の一端に加える基準電圧も変更する必要があるからである。従って、Ｙドライバを非選択電圧を共通化し、非選択電圧を基準として、選択電圧を絶対値が同じ正負電圧の組（必ずしも１組である必要はない。）で動く構成として、Ｘドライバも同様に絶対値の同じ正負電圧（必ずしも１組である必要はない）で動く構成にすることによって、電圧Ｖ１とＶ４を切り替える比較的高耐圧のスイッチ回路６３３は不要となり、また抵抗器６３１の一端に加える基準電圧の値は任意の一定電圧で良くなる。例えば、基準電圧を電圧Ｖ０とＶ５の中点の電圧に設定しても良い。

【００６０】さらに、図６のＹドライバ１２と同等のＦＲ信号が変化すると非選択電圧が電圧Ｖ１(４)からＶ４(１)に切り替わる構成のＹドライバであっても、ＦＲ信号が変化する時に補正電圧を強制的に発生させないような回路（例えば、抵抗器６３１を短絡する低耐圧のスイッチ）構成にすることによっても、スイッチ回路６３３は不要となり、また抵抗器６３１の一端に加える基準電圧の値は任意の一定電圧で良くなる。

【００６１】また、本実施例では信号電極の駆動電圧波形に補正電圧を付け加えているが、ボルテージ・ホロワ回路６３２が出力する電圧の極性を反転させる反転増幅回路を設け、この出力電圧を補正電圧として、これを走査電極の駆動電圧波形に付け加えることによって、実施例２と同じ効果が得られる。

【００６２】［実施例４］また、さらにＹドライバの出力波形ないし走査電極上の電圧波形の歪は、Ｙドライバ及び走査電極に電流が流れることによって発生する。そして、この電流はＹドライバを介して電源回路に流入する。従って、この電源回路に流れる電流を検出することによって、歪を推定出来る。これによって、Ｘドライバに供給する電圧を変化さてもよい。

【００６３】これを、図７を用いてさらに詳しく説明する。図７はこの実施例の構成を示す。図で電源回路７３以外は図１の構成と同じであり説明を省略する。さらに図６の電源回路７３で、抵抗器７３１、７３２、差動増幅回路７３３、７３４以外の構成要素は図１の電源回路１３と同じなので説明を省略する。抵抗器７３１、７３２は電流検出抵抗で微小な抵抗値を持ち、この抵抗器に流れる電流に比例した電圧を抵抗器の両端に発生させる。差動増幅回路７３３、７３４はそれぞれ抵抗器７３１、７３２の両端に発生する電圧差を電圧加算回路に出力する。この電圧差に基づいて電圧加算回路１３７～１４０で電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ５’を発生する。以上の構成と動作をする。

【００６４】従って、実施例１と同様の動作をするから同様の効果を得るとともに、実施例１で必要であった基準電圧切り替えスイッチ１３２、入力電圧切り替え制御回路１３３、入力電圧切り替えスイッチ１３５が不要となりより回路を簡素化できる。

【００６５】また、差動増幅回路７３３、７３４の出力する電圧の極性を反転した電圧を補正電圧として、これを走査電極の駆動電圧波形に付け加えることによって実施例２と同じ効果が得られる。

【００６６】なお、本実施例では非選択電圧の電流を検出する方法を示したが、各信号電極が走査電極上の駆動電圧波形（非選択電圧）に発生する歪は各信号電極に印加する電圧が点灯電圧から非点灯電圧、非点灯電圧から点灯電圧に切り替わるときの各信号電極に流れる電流の総和に他ならないから、例えば図７のＸドライバ１１に供給される点灯電圧、非点灯電圧の電流を微小な値の抵抗器等で各々検出しそれを足し合わせることによっても走査電極上の駆動電圧波形（非選択電圧）に発生する歪を推定することが出来、これによって補正電圧を作ることも容易に出来、同様の効果が得られる。

【００６７】［実施例５］実施例１～４では液晶パネルの信号電極の配列方向に発生する表示むらを解消した。ここで、次に液晶パネルの走査電極の配列方向に発生する表示むら（以後、この表示むらを横糸引きと言う。）を解消する実施例を示す。この横糸引きは、筆者が出願した特開平２－８９号公報で詳しく説明してあるが、簡単に言えば各走査電極上の表示ドットがより多く点灯することによってこの走査電極上の表示ドットが作るコンデンサの容量が大きくなって走査電極の駆動電圧波形が非選択電圧から選択電圧に切り替わる時により多くなまる為にその走査電極上の表示ドットに印加する実効電圧が小さくなって横糸引きが発生する。即ち、選択電圧に切り替わる時の波形のなまり量によって横糸引きが規定される。

【００６８】従って、液晶パネルの信号電極が形成されている基板上に電圧検出電極を形成し、この電圧検出電極を信号電極と液晶層によって容量結合させ、走査電極の電圧変化の総和を検出し、この結果より、走査電極上のなまりを推定してＹドライバに供給する選択電圧を変化させることによって、この表示むらを解消出来る。

【００６９】これを、図８を用いてさらに詳しく説明する。図８はこの実施例の構成を示す。図で液晶パネル１０ｂと電源回路８３以外は図１の構成と同じであり説明

を省略する。

【００７０】図８で液晶パネル１０ｂは図１の液晶パネル１０の基板１０２上に新たに電圧検出電極ＸＤを付け加えたものである。電圧検出電極ＸＤは図に示すように走査電極Ｙ１～Ｙ６の全てに対向するように設けてある。

【００７１】図８で８３は電源回路で、８３１～８３３以外の構成要素は図１の電源回路１３と同じなので説明を省略する。８３１は反転増幅回路でボルテージ・ホロワ回路６３２が出力する電圧を反転する。８３２、８３３は加算器で図１の加算器１３７と同じ回路構成と機能をする。

【００７２】以上の構成となっている。ここで、液晶パネル１０ｂが走査電極Ｙ３上の表示ドットが多く点灯し、他の走査電極上の表示ドットが少なく点灯しているような表示を行う場合のボルテージ・ホロワ回路６３２が出力する電圧と各走査電極上の電圧波形を模式的に図９に示す。図で９０１はボルテージ・ホロワ回路６３２が出力する電圧波形、９０２～９０４は各々走査電極Ｙ２～Ｙ４上の電圧波形を示す。なお、９０２～９０４は仮りに走査電極の駆動波形に補正電圧を付け加えないとした場合の電圧波形である。ここで、電圧波形９０１は全ての走査電極Ｙ１～６の電圧波形の変化の総和となり、図では走査電極Ｙ２～４に順次選択電圧が切り替わって印加する部分を示している。

【００７３】図９で示すように、走査電極Ｙ２からＹ３に選択電圧が印加する走査電極が切り替わる時は走査電極Ｙ３上の電圧波形９０３は大きくなまって選択電圧になるので、ボルテージ・ホロワ回路６３２が出力する電圧９０１もこれとほぼ同じ大きさの大きな微分波形を発生する。そして、走査電極Ｙ３からＹ４に選択電圧が印加する走査電極が切り替わる時は走査電極Ｙ４上の電圧波形９０４は殆どなまらずに選択電圧になるので、ボルテージ・ホロワ回路６３２が出力する電圧９０１も小さな微分波形を発生する。

【００７４】ここで、ボルテージ・ホロワ回路６３２の出力は反転増幅回路８３１で極性反転されて、これを補正電圧として加算器８３２、８３３で選択電圧に付け加える。

【００７５】従って、走査電極Ｙ３上の電圧波形９０３は大きくなまって選択電圧になろうとする時は、より大きな補正電圧が付け加えられた選択電圧が印加するので、実際にはより早く選択電圧に達するように矯正される。

【００７６】よって、各走査電極上の表示ドットの点灯している数によらずにほぼ非選択電圧から選択電圧に切り替わる時のなまり方はほぼ同じになって、横糸引きを防止することが出来る。

【００７７】［実施例６］さらに、Ｙドライバの出力波形ないし走査電極上の電圧波形の歪は、Ｙドライバ及び走査電極に電流が流れることによって発生するから、ある走査電極に選択電圧が印加する時にこの走査電極上の表示ドットが多く点灯している場合に多い場合に電圧波形は大きくなまるが、これはより多くの電流がこの走査電極に流れているのに他ならない。従って、この走査電極に流れる電流、言い替えれば電源回路の選択電圧を発生する部分に流れる電流を検出することによって、歪を推定出来る。これによって、Ｙドライバに供給する電圧を変化させてもよい。

【００７８】これを、図１０を用いてさらに詳しく説明する。図１０はこの実施例の構成を示す。図で電源回路１０３以外は図７の構成と同じであり説明を省略する。さらに図１０の電源回路１０３で、抵抗器１０３１、１０３２、差動増幅回路１０３３、１０３４、加算器１０３５、１０３６以外の構成要素は図７の電源回路７３と同じなので説明を省略する。抵抗器１０３１、１０３２は電流検出抵抗で微小な抵抗値を持ち、この抵抗器に流れる電流に比例した電圧を抵抗器の両端に発生させる。差動増幅回路１０３３、１０３４はそれぞれ抵抗器１０３１、１０３２の両端に発生する電圧差を任意倍した電圧をそれぞれ電圧加算回路に出力する。これらの電圧差を電圧加算回路１０３５、１０３６は電圧Ｖ０、Ｖ５にそれぞれ加算して電圧Ｖ０’、Ｖ５’を発生する。以上の構成と動作をする。

【００７９】従って、ある走査電極に選択電圧が印加する時にこの走査電極上の電圧波形が大きくなまろうとする時に、抵抗器１０３１、１０３２には大きな電流が流れるので、電圧Ｖ０’、Ｖ５’は非選択電圧に対して電圧Ｖ０、Ｖ５より大きな絶対値の電圧となる。従って、この走査電極上の電圧波形の大きななまりが解消される。これによって、実施例５と同様の効果が得られる。

【００８０】［実施例７］実施例３では液晶パネルの走査電極が形成されている基板上に電圧検出電極を１本形成し、この電圧検出電極を信号電極と液晶層によって容量結合させ、信号電極の電圧変化の総和を検出し、この結果より、走査電極上の歪を推定してＸドライバに供給する電圧を変化させていた。しかし、走査電極数が多くなると、言い替えれば各信号電極の長さが長くなると、各信号電極のＸドライバに近い部分と遠い部分とで電圧変化の度合いが異なってしまい、正確に走査電極上の歪を推定するのが難しい場合がある。このような場合には電圧検出電極を複数本形成しこれらの電圧検出電極が検出する電圧を各々適宜重み付けして、言い替えればこれらの電圧を変数とするある適当な関数とした補正電圧を発生させてこれによって信号電圧の駆動波形にこの補正電圧を付け加えれば良い。

【００８１】これを、図１１を用いてさらに詳しく説明する。図１１はこの実施例の構成を示す。図で液晶パネル１０ｃと電源回路１１３以外は図１の構成と同じであり説明を省略する。

【００８２】図１１で液晶パネル１０ｃは図１の液晶パネル１０の基板１０１上に新たに電圧検出電極ＹＤ１、２をそれぞれ図に示すように信号電極Ｘ１～Ｘ６の全てに対向するように上下の両辺部に設けてある。ここで、信号電極Ｘ１からＸ６上の電圧変化による走査電極上に発生させる影響が各信号電極毎に異なる場合には、電圧検出電極ＹＤの幅は一様でなくとも良く、例えば左から右になるに従って広くなるように形成しても良い。

【００８３】図１１で１１３０は電源回路で、６３１１、６３１２、６３２１、６３２２と１１３１～１１３４以外の構成要素は図１の電源回路１３と同じなので説明を省略する。６３１１と６３１２は抵抗器でそれぞれ電圧検出電極ＹＤ１、２がこれに対向する信号電極Ｘ１～Ｘ６からなるコンデンサとで微分回路を形成する。６３２１、６３２２はボルテージ・ホロワ回路で電圧検出電極ＹＤ１、２に発生する電圧をそれぞれインピーダンスを下げて出力する。なお、この回路は必ずしも１倍の増幅率でなく任意の倍率の非反転増幅器であっても構わない。１１３１～１１３４は加算器で電圧Ｖ０、Ｖ２、Ｖ３、Ｖ５に２つのボルテージ・ホロワ回路６３２１、２が出力する電圧を加算して、それぞれ電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ５’を発生する。

【００８４】以上の構成と動作をする。ここで、加算器１１３１～１１３４の一構成例を図１２に示す。図で、１２０１は抵抗器、１２０２、１２０３はコンデンサで２入力の微分回路を形成し、１２０４は演算増幅回路によるボルテージ・ホロワ回路である。また端子Ｖｉｎ１、２はそれぞれ図１１のボルテージ・ホロワ回路６３２１、２の出力する電圧を入力し、端子Ｖｒｅｆは電圧Ｖ０、Ｖ２、Ｖ３、Ｖ５のいずれかの電圧を入力する。図１２の端子Ｖｏｕｔはボルテージ・ホロワ回路２０３の出力で図１１の電圧Ｖ０’、Ｖ２’、Ｖ３’、Ｖ５’と対応する。ここで、図１２で端子Ｖｉｎに入力するボルテージ・ホロワ回路６３２１、２の出力する電圧はほぼ微分波形に近いのでこれらの電圧を抵抗１２０１とコンデンサ１２０２、１２０３からなる微分回路の端子Ｖｉｎ１、２に接続することによって、近似的に端子Ｖｒｅｆの電圧に端子Ｖｉｎ１、２の電圧を加えた電圧をボルテージ・ホロワ回路１２０４から出力することが出来る。

【００８５】ここで、コンデンサ１２０２、１２０３の静電容量を同じにすると結果的に端子Ｖｉｎ１、２の電圧を均等に重み付けされた補正電圧となり、言い替えれば平均化されたものとなる。またこの２つのコンデンサの静電容量を異なった値、例えばコンデンサ１２０２より１２０３の静電容量を大きくすることによって、電圧検出電極ＹＤ２の電圧変化の補正電圧に対する寄与を大きくすることが出来る。

【００８６】これらのコンデンサ１２０２、１２０３の静電容量は実験等で容易に設定することが出来る。また、コンデンサ１２０２、１２０３の静電容量を同じに設定しておき図１１の電圧検出電極ＹＤ１よりＹＤ２を例えば幅広くすることによって、同じよう補正電圧に対する寄与を大きくすることが出来る。

【００８７】従って、実施例３と同様の動作をし、さらに電圧検出電極を複数本化することによって、走査電極上の駆動波形に発生する歪をより正確に検出することができるので、より表示むらを解消することが出来た。

【００８８】なお、実施例３に対する実施例５と同様に、複数の電圧検出基板を信号電極が形成されている基板上に走査電極Ｙ１～Ｙ６の全てに対向するように左右の両辺部に設けて、電源部を同様の回路構成にすることによって、横糸引きについても本実施例と同様の効果が得られる。

【００８９】［実施例８］実施例７では液晶パネルの走査電極が形成されている基板上に電圧検出電極を複数本形成し、これらの電圧検出電極に発生する電圧を複数の変数とした関数の電圧を１つの補正電圧として用いたが、例えば液晶パネルの左側の信号電極の駆動電圧波形の変化の総和と右側の信号電極の駆動電圧波形の変化の総和とが全く異なる場合にはこれらの信号電極に異なった補正電圧を加えた方がより表示むらを解消することが出来る。従って、複数の電圧検出電極から得られる電圧変化から複数の補正電圧を発生させて、これらの補正電圧について、ある補正電圧を発生させる電圧検出電極が交差する信号電極あるいは走査電極毎の駆動電圧波形にその補正電圧を個別に付け加えることによって、さらに表示むらを改善出来る。これを図１３を用いてさらに詳しく説明する。図１３に本実施例の一構成例を示す。

【００９０】図でＹドライバ１２は図１のＹドライバと同じ構成と動作をするので説明を省略する。

【００９１】図１３で１０ｄは液晶パネルで、図１の液晶パネル１０の基板１０１上に新たに電圧検出電極ＹＤ１、２が図に示すようにお互いに突き合わされて信号電極Ｘ１～Ｘ６の一部に各々対向するように上辺部に設けてある。ここで、電圧検出電極ＹＤ１、２の突き合わせ部分は本実施例では楔状となってある信号電極（本実施例では信号電極Ｘ２～Ｘ５）と共有して交差している。しかし、必ずしも突き合わせ部が同じ信号電極と共有して交差する必要は無い。さらに２つの電圧検出電極ＹＤ１、２は分離してなくとも良い。即ち、短絡させてあっても良い。

【００９２】１１Ｌ、１１Ｍ、１１ＲはＸドライバで、図１のＸドライバ１１と内部の各回路の構成ビット数が異なっている以外は同じ構成と動作をする。そして、これらのＸドライバ１１Ｌ、１１Ｍ、１１Ｒにはそれぞれ異なった電圧構成の電圧が供給されて、この電圧によって各々駆動電圧波形を出力する。

【００９３】１３３は電源回路で、１３３１～１３３３以外の構成と動作は図１１の電源回路１１３０と同じな

ので説明を省略する。

【００９４】１３３１、１３３３は加算器群で図２で示される加算器からなり電圧Ｖ０、Ｖ２、Ｖ３、Ｖ５に対応して設けられている。

【００９５】１３３２は加算器群で、この加算器は図１２で示される加算器からなり電圧Ｖ０、Ｖ２、Ｖ３、Ｖ５に対応して設けられている。

【００９６】加算器群１３３１、１３３２、１３３３の出力する電圧はそれぞれＸドライバ１１Ｌ、１１Ｍ、１１Ｒに供給される。

【００９７】以上の構成となっているので、電圧検出電極ＹＤ１には信号電極Ｘ１～５までの駆動電圧波形の電圧変化の総和が発生する。ここで、電圧検出電極ＹＤ１の先端部は楔状となっているので、信号電極Ｘ１からＸ５へ向かう程、駆動電圧波形の電圧変化の重み付けが小さくなっている。同様に電圧検出電極ＹＤ２にも信号電極Ｘ１～５までの駆動電圧波形の電圧変化の総和が発生するが、信号電極Ｘ５からＸ１へ向かう程、駆動電圧波形の電圧変化の重み付けが小さくなっている。

【００９８】従って、ボルテージ・ホロワ回路６３２１は主に液晶パネル１０ｄの左側の信号電極の駆動電圧波形の電圧変化の総和を出力し、ボルテージ・ホロワ回路６３２２は主に右側の信号電極の駆動電圧波形の電圧変化の総和を出力する。

【００９９】ここで、ボルテージ・ホロワ回路６３２１の出力電圧は補正電圧として加算器群１３３１に供給され、加算器群１３３１の出力はＸドライバ１１Ｌに供給される。同様にボルテージ・ホロワ回路６３２２の出力電圧は補正電圧として加算器群１３３３に供給され、加算器群１３３３の出力はＸドライバ１１Ｒに供給される。そして、ボルテージ・ホロワ回路６３２１、６３２２の出力を２つの補正電圧として加算器群１３３２に供給し、加算器群１３３２はこの２つの補正電圧を平均化した補正電圧を付け加えた電圧をＸドライバ１１Ｍに出力する。

【０１００】以上の動作をするので、液晶パネル１０ｄの左側の信号電極の駆動電圧波形にはこの左側の信号電極の駆動電圧波形の変化に多く重み付けされた駆動電圧波形の変化の総和による補正電圧が付け加わり、左側の信号電極の駆動電圧波形には右側の信号電極の駆動電圧波形の変化に多く重み付けされた補正電圧が加わり、中央部では左右の平均化した補正電圧が加わることになる。

【０１０１】従って、各信号電極の駆動電圧波形には略最適な補正電圧が個々に付け加わってより一層表示むらを解消することが出来た。

【０１０２】なお、本実施例では加算器群１３３１、１３３３を図２で示される加算器としたが、図１２で示される加算器とし、加算器群１３３２と同様にボルテージ・ホロワ回路６３２１、６３２２の２つの出力を入力して、この２つの入力電圧の寄与分を図１２のコンデンサ１２０２と１２０３の静電容量で適宜設定して、出力しても良い。

【０１０３】また、本実施例では異なった補正電圧の数を３としたがこれは液晶パネルの大きさ等で適宜増減しても構わない。

【０１０４】さらに、本実施例では電圧検出電極を用いた方法を示したが、例えば図１３のＸドライバ１１Ｌ、Ｍ、Ｒの各々について、これらのＸドライバに供給される点灯電圧、非点灯電圧の電流をそれぞれ微小な値の抵抗器等で各々検出しそれを足し合わせることによっても本実施例と同じような複数の補正電圧を得ることが出来、これを用いて同様の補正を行うことによって、本実施例と同様の効果が得られる。

【０１０５】以上、述べたように付け加える補正電圧を信号電極の液晶パネルの位置するところによって異なった補正電圧とすることで、より一層表示むらを解消することが出来た。

【０１０６】［実施例９］実施例８では液晶パネルの走査電極が形成されている基板上に電圧検出電極を複数本形成し、これらの電圧検出電極に発生する電圧を複数の変数とした関数の電圧を３つの補正電圧として用いたが、例えば電圧検出電極を１本形成し、この電圧検出電極に発生する電圧をから３つの補正電圧を発生させ、個別の信号電極の駆動電圧波形にある１つの補正電圧を付け加えても良い。例えば、筆者等の実験で液晶パネルの走査電極の駆動電圧波形を印加する端子が左側にある場合には、１本の電圧検出電極から得られた電圧を小さく増幅した補正電圧を液晶パネルの左側に位置する信号電極に、大きく増幅した補正電圧を液晶パネルの右側に位置する信号電極に、付け加えることによって表示むらがより解消することが実験的に解った。これを図１４に示す。図１４は本実施例の一構成例を示す。

【０１０７】図で１０ａは液晶パネル、１２はＹドライバで図６と同じ構成となっており、また１１Ｌ、Ｍ、ＲはＸドライバで図１３と同じ構成となっている。

【０１０８】さらに１４３は電源回路で１４３１～１４３３以外は図６の電源回路６３と同じ構成となっている。そこで、これらの説明は省略する。

【０１０９】図１４で１４３１～１４３３は加算器群でそれぞれ図２に示す加算器で構成されている。但し、図２のコンデンサ２０２の容量は加算器群１４３１では小さく、１４３３では大きく、１４３２ではその間の値をとるようになっている。

【０１１０】即ち、端子Ｖｉｎに加わる電圧が同じでも、付け加えられる補正電圧が加算器群１４３１が一番小さく、次に１４３２、そして１４３３が最も大きくなるように設定されている。

【０１１１】以上の構成となっているので、電圧検出電極から得られた電圧から複数の補正電圧を発生させるこ

とが出来、走査電極の駆動端子から遠い信号電極程大きな補正電圧が駆動電圧波形に付け加えることができるので、より一層表示むらを解消することが出来た。

【０１１２】［実施例１０］実施例３等では電圧検出電極の形状について、特に詳しく触れなかったが液晶パネルの形状によっては、電圧検出電極の形状を変えることによってより一層表示むらを解消することが出来る。これを図１５を用いて説明する。図１５は液晶パネルの構成を示す図である。本図は図１４の液晶パネル１０ａと各電極の形状が異なる以外は同じである。ここで、走査電極Ｙ１～Ｙ６の形状は液晶パネル１０ａと同じ形状をしており、信号Ｘ１～Ｘ６は上下交互に駆動電圧が供給される端子が形成されている。（図１５ではＸ１、３、５と奇数番号の信号電極が上にこの端子が形成されている。）ここで、電圧検出電極ＹＤは上辺部分に各信号電極と交差するように形成されている。そして、電圧検出電極ＹＤは奇数番号の信号電極と交差する部分では幅が狭く、偶数番号の信号電極と交差する部分では幅が広くなるように形成されている。

【０１１３】以上のような形状に電圧検出電極ＹＤを形成してある。

【０１１４】これによって、駆動電圧が印加する端子が近い信号電極と電圧検出電極ＹＤの容量結合は小さくなり、駆動電圧が印加する端子が遠い信号電極と電圧検出電極ＹＤの容量結合は大きくなる。よって、電圧検出電極ＹＤの位置で、減衰の少ない奇数番号の信号電極上の駆動電圧波形の変化によって小さな重み付けで電圧検出電極ＹＤに微分電圧を発生させ、減衰の大きな偶数番号の信号電極上の駆動電圧波形の変化は大きな重み付けで電圧検出電極ＹＤに微分電圧を発生させる。

【０１１５】よって、電圧検出電極ＹＤに対して、駆動電圧波形を印加する端子が遠い信号電極と近い信号電極の電圧変化を均等に電圧検出電極ＹＤが取り込むことが出来る。これによって、より正確に走査電極上に発生する歪を推測出来、ひいてはより正確な補正電圧を発生することが出来るのでより一層表示むらを解消出来る。

【０１１６】［実施例１１］実施例３等では電圧検出電極が検出した電圧を一定の倍率で増幅した電圧を補正電圧としていた。ここで、電圧検出電極と対向する信号電極との電圧差は概ね０Ｖである。しかし、実際の走査電極と対向する信号電極との電圧差は実効電圧で数Ｖ程度である。液晶は一般に印加する実効電圧が大きくなるとその誘電率が大きくなる。このことは液晶パネルの表示ドットが多く点灯することによって、液晶パネルが作るコンデンサの静電容量が大きくなることを意味する。従って、信号電極の駆動波形の電圧変化の総和が同じでも、より多くの歪を各走査電極上の駆動電圧波形に発生させる。しかし、電圧検出電極と対向する信号電極との容量結合の度合いは表示の如何によらず一定なので、表示の点灯ドット数の多少によって、補正電圧が不足することになる。よって、表示の点灯ドット数の多少によって補正電圧の量を増減することにより、点灯ドット数の如何によらず表示むらのない表示が行える。これを、図１６で説明する。図１６は本実施例の一構成例を示す。図で電源回路１６３と点灯ドット数計数回路１６４以外の構成は図６の構成と同じであり説明を省略する。図１６の１６４は点灯ドット数計数回路で計数回路１６４１とラッチ回路１６４２からなる。計数回路１６４１はＣＫ信号に同期してデータ信号が〝１〟の時カウント・アップしＤＩ信号に同期して計数値をラッチ回路１６４２に取り込ませると同時に計数値を０にして再び計数を開始する。ラッチ回路１６４２の出力は電源回路１６３の可変増幅器１６３１に取り込まれる。

【０１１７】１６３は電源回路で１６３１以外の構成は図６の構成と同じであり説明を省略する。１６３１は可変増幅器で点灯ドット数計数回路１６４の数値が大きくなると増幅率が大きくなる増幅回路である。この回路の一構成例を図１７に示す。

【０１１８】図で１７１は演算増幅器、１７２～１７５は抵抗器で１７３は１７４の半分の抵抗値、１７４は１７５の半分の抵抗値を持つ。１７６～１７８はスイッチ回路で各々抵抗器１７２～１７５に並列に接続されている。これらの抵抗とスイッチ回路は本実施例では３個となっているがこの数は適宜増減しても構わない。Ｖｒｅｆ、Ｖｉｎ端子にはそれぞれ図１６のスイッチ回路６０３の出力、ボルテージ・ホロワ回路６３２の出力が接続してある。従って、抵抗１７２の抵抗値と抵抗器１７３と１７５の間の抵抗値の比によった増幅率を持つ非反転増幅回路が形成されてＶｒｅｆ端子の電圧を基準にＶｉｎ端子に入力された電圧がこの増幅率で増幅されて出力される。ここで、スイッチ回路１７６～１７８は点灯ドット数計数回路１６４が出力する複数ビットのバイナリの数値でオン／オフ制御される。即ち、バイナリ数値が〝１〟の場合にオフ、〝０〟の場合にオンになる。また、上位の数値がスイッチ回路１７８の制御を行い、下位の数値がスイッチ回路１７６の制御を行う。これにより、数値が大きくなると抵抗器１７３と１７５の間の抵抗はこれに比例して大きくなる。従って、点灯ドット数が多くなると増幅率が大きくなる。

【０１１９】以上の構成となっているので、液晶パネル１０ａの表示ドットが多く点灯すると補正電圧も大きくなって、点灯ドット数の如何によらず表示むらのない表示が行える。

【０１２０】［実施例１２］実施例４では電源回路７３中の非選択電圧（Ｖ１、Ｖ４）に流れる電流を検出することによって、Ｘドライバ１１に供給する電圧に補正電圧を付け加えたが、Ｙドライバ１２に供給する電圧に補正電圧を付け加えても良い。これを図１８を用いて説明する。図１８は本実施例の具体的な一構成例を示す。図で電源回路１８３以外は図１の構成と同じであり、説明

を省略する。さらに電源回路１８３中の１４１、ＯＰ２、ＯＰ３はそれぞれ図１の同番号と同じものである。１８１０、１８４０は、それぞれ電圧Ｖ１、Ｖ４に補正電圧を付け加える電圧補正回路であり、電圧分割回路１３１とＹドライバ１２の間に設けられてある。電圧補正回路１８１０、１８４０は同じ回路構成となっており、図１９に電圧補正回路１８１０、１８４０の具体的な一構成例を示す。ここで、以下、実施例１２～１６に於いて、ＦＲ信号に応じて非選択電圧が電圧Ｖ１が使用される期間について説明を行うが、電圧Ｖ４が使用される期間についても同様である。図１９で、Ｖｉｎ端子は電圧Ｖ１（あるいはＶ４）を入力する端子である。１９１１は電流検出用の抵抗器であり、非選択電圧が印加される走査電極に流れる電流の総和に比例した電圧がその両端に発生する。この電圧は演算増幅器１９１３、抵抗器１９１４、１９１５によって構成される反転増幅回路１９１２に印加する。反転増幅回路１９１２の増幅率を抵抗器１９１４、１９１５の抵抗値により適当な値に設定することによって、反転増幅器１９１２の出力する電圧（これをＶｄとする）を過渡電流の影響で歪んだ非選択電圧が印加された走査電極上の電圧とほぼ等しくすることが出来る。演算増幅器１９１６は演算増幅器１９１６の反転入力に印加された電圧Ｖ１’と非反転入力に印加されたＶｉｎ端子からの電圧を等電圧とする電圧（これをＶｃとする）をＹドライバ１２に出力する。

【０１２１】以上の構成と動作をするので、過渡電流が流れる場合にも非選択電圧が印加した走査電極上の電圧と電圧Ｖ１（あるいは電圧Ｖ４）は常に同じ電圧に保たれる。

【０１２２】以上、述べたように電源回路中の非選択電圧（電圧Ｖ１とＶ４）に流れる電流を検出し、Ｙドライバ１２に供給する非選択電圧に補正電圧を付け加えることによって、非選択電圧が印加した走査電極上の電圧の変動を抑えることが出来、実施例１と同様、容易で簡素に表示むらを解消することが出来た。

【０１２３】［実施例１３］実施例１２の電圧補正回路１８１０、１８４０の回路構成は図１９で示した構成である必要は無く、他の回路構成でも構わない。ここで、図２０に電圧補正回路の他の回路構成の一例を示す。図２０の１９１１～１９１６についてはそれぞれ図１９の同番号に対応している。２０１７はコンデンサで、抵抗器１９１４との組み合わせで反転増幅回路１９１２の時定数τ１を設定する。同様に、２０１８、２０１９はそれぞれ抵抗器、コンデンサで演算増幅回路１９１６の時定数τ２を設定する。

【０１２４】以上の構成となっており、これら、時定数τ１、τ２と実施例１２で前述した増幅率の値を適当な値に設定することによって、電圧Ｖ１（あるいはＶ４）に過渡電流が流れた時にも、非選択電圧が印加した走査電極上の電圧の１ＬＰ信号周期当たりの実効電圧値を電圧Ｖ１と等しくすることが出来、実施例１２と同様の効果がある。さらに、増幅回路１９１３、１９１６の出力電圧の単位時間当たりの電圧変化量は小さくなるので、スルー・レートの低い安価な演算増幅器を用いることが出来、また回路の安定性も向上させることが出来た。なお、本実施例では電源回路内を流れる非選択電圧の電流を検出する場合について述べたが、選択電圧の電流を検出する場合、さらに電圧検出電極を用いて補正電圧を発生させる場合にも同様の回路構成をとることによって、同様の効果が得られる。

【０１２５】［実施例１４］実施例１２、１３等では電源回路中に流れる電流を微小な抵抗を持つ抵抗器で検出したが、電流検出に必ずしも抵抗器を使用する必要は無く、他の素子を用いても良い。ここで、図１９の電圧補正回路１９１０、１９４０の電圧補正回路の代わりとして、図２１に他の素子としてトランスを用いた場合の電圧補正回路の具体的な一構成例を示す。図２１の演算増幅回路１９１６は図１９の同番号のものと同じである。２１２０はトランスで、１次巻線２１２１と２次巻線２１２２からなる。ここで、１次巻線２１２１と２次巻線２１２２の巻数の比を適当な値にすることによって、実施例１２と同様の効果が得られた。さらには構成要素数を少なく出来た。

【０１２６】ここで、本実施例にさらに抵抗器とコンデンサを付け加えた他の電圧補正回路の構成例を図２２に示す。図２２で２２２３、２２２４の抵抗器、コンデンサが図２１の電圧補正回路に付け加わっている。この付け加わった抵抗器、コンデンサによって、演算増幅回路１９１６の時定数τ２が設定され、実施例１３と同じ効果が得られた。

【０１２７】［実施例１５］実施例１２～１４等ではいわばほぼリアル・タイムにＹドライバ１２に供給する非選択電圧を変化させたが、例えば前述の実施例１２に於いて、電圧補正回路１８１０、１８４０を図２３に示す電圧補正回路にすることによって、実施例１２と同じ効果が得られると共に電圧補正回路の動作を安定にすることが出来る。即ち、図２３に示すように反転増幅回路１９１２と演算増幅回路１９１６との間にスイッチト・キャパシタ回路やＣＣＤ等の遅延素子２３２５を挿入することによって、補正電圧を同ＬＰ信号周期内で一定時間遅らせて非選択電圧に付け加え、これをＹドライバ１２に供給しても実施例１２と同じ効果が得られるとともに、非リアル・タイムのフィード・バックがあるために、補正電圧回路が発振しずらくなって、安定した動作が得られる。この遅延素子を挿入することは例えば、実施例１３、１４でも適用することが出来、同様の効果が得られる。

【０１２８】［実施例１６］１ＬＰ周期ごとに、ＬＰ１周期開始時、あるいは開始後所定の時間が経過した時に現れる電源回路中の非選択電圧に流れる瞬間電流値、あ

るいはピーク電流値を検出し、検出された電流値に応じた補正電圧を同ＬＰ周期の期間の一定な補正電圧として、非選択電圧（Ｖ１あるいは Ｖ４）に付け加えても良い。これを、図２４で説明する。図２４は図１８の電圧補正回路の構成を示す図である。１９１１～１９１５は図１９の同番号と同じものである。図２４で、２４２６はサンプル&ホールド回路で、ＬＰ信号あるいはＬＰ信号を所定の時間だけ遅らせた信号によって、過渡電流に対応して反転増幅回路１９１３より出力する電圧Ｖｄを演算増幅回路１９１６の出力電圧Ｖｃを基準として、サンプルし、ホールドする回路である。即ちｄＶ＝Ｖｄ－Ｖｃなる電圧をホールドする。

【０１２９】従って、演算増幅回路１９１６の非反転入力にはＶｃ＋ｄＶが印加するので、Ｖ１（Ｖ４）－ｄＶなる一定の電圧が同ＬＰ期間出力される。

【０１３０】以上の動作をし、ホールドされた電圧Ｖｄは、非選択電圧が印加した走査電極上の電圧の１ＬＰ周期当たりの実効電圧－Ｖ１（Ｖ４）に比例するから、反転増幅回路１９１２の増幅率を適当な値に設定することによって、過渡電流が発生する時にも、非選択電圧が印加した走査電極上の電圧の１ＬＰ周期当たりの実効電圧を電圧Ｖ１（Ｖ４）に等しくすることが可能になり、実施例１２と同様の効果が得られた。

【０１３１】なお、本実施例では電源回路内を流れる非選択電圧の電流を検出する場合について述べたが、選択電圧の電流を検出する場合、さらに電圧検出電極を用いて補正電圧を発生させる場合にも同様の回路構成をとることによって、同様の効果が得られる。

【０１３２】［実施例１７］前述の実施例１６ではＹドライバ１２に供給する非選択電圧に付け加える補正電圧を変化させることにより、非選択電圧が印加された走査電極上の電圧あるいは電圧実効値の補正を行ったが、詳細については述べないが、例えば、実施例１６と同様に電源回路の非選択電圧の電流を検出して、この検出した電流値に応じた時間だけ所定の補正電圧を付け加えることによっても実施例１７と同様の効果が得られる。また、これは実施例１６と同様に選択電圧の電流を検出する場合、さらに電圧検出電極を用いて補正電圧を発生させる場合にも同様の回路構成をとることによって、同様の効果が得られる。

【０１３３】［実施例１８］いままで、走査電極、信号電極ともに一方の端から駆動電圧波形を印加する構造の液晶パネルについてのみ述べてきたが、走査電極、信号電極のいずれかあるいは両方について両方の端駆動電圧波形を印加する構造の液晶パネルについても上述の実施例を適応出来る。又、電圧検出電極を設けて補正電圧を発生する実施例においては、電圧検出電極の電圧を取り出す端子も一方の端だけではなく両端から検出するような回路構成、あるいは走査電極、信号電極の駆動電圧端子のある側と反対側に電圧検出電極の端子を形成しても良い。さらに電圧検出電極は上下左右どの辺の近くに形成しても良く、表示に差し支えなければ例えば中央部分に形成してもよい。

【０１３４】さらに実施例１から１７の内の幾つかを複合して用いることも容易で、例えば実施例３と実施例５を複合することによって縦糸引きと横糸引きの両方の表示むらを解消することが出来る。

【０１３５】さらにまた、本実施例１～１７では１対の基板上に１組の複数の信号電極及び複数の走査電極がお互い交差して表示ドットを作る液晶パネルの場合について説明したが、１対の基板上に２組の複数の信号電極及び２組の複数の走査電極がお互い、各組毎に交差して表示ドットを作る液晶パネル、いわゆる２画面駆動の液晶パネルについても、それぞれの画面に応じた補正電圧をそれぞれの画面を駆動するＸないしＹドライバの電源電圧に付け加えることによって、同様の効果が得られる。そして、この時、一方の画面を駆動するＸないしＹドライバに供給するＦＲ信号を反転した信号を他方の画面を駆動するＸないしＹドライバに供給するＦＲ信号として、供給することによって回路構成を一部共有化出来、回路構成を簡素化出来る。即ち、一方の画面が選択、非選択、点灯、非点灯電圧としてＶ０（５）、Ｖ４（１）、Ｖ５（０）、Ｖ３（２）を用いる時に、他方の画面はＶ５（０）、Ｖ１（４）、Ｖ０（５）、Ｖ２（３）を用いるので、例えば、非選択電圧に補正電圧を付け加える方法の場合に、一方の画面がＶ１を用いる時に、Ｖ１に一方の画面の表示に応じた補正電圧を付け加え、この画面を駆動するＹドライバに供給すると同時に、Ｖ４に他方の画面の表示に応じた補正電圧を付け加え、この画面を駆動するＹドライバに供給することが出来る。従って、補正電圧回路を共有することが出来る。

【０１３６】［実施例１９］なお、本明細書では説明を簡単にする為に主に電圧平均化駆動方法を例に説明してきたが、走査電極に選択電圧が印加する期間中に信号電極に印加する電圧が変化する駆動方法（例えば、点灯電圧と非点灯電圧が印加する時間が増減する、いわゆるパルス幅変調による階調表示方法）、複数の走査電極に同時に選択電圧を印加する駆動方法、走査電極あるいは信号電極に多くの電圧レベルからなる駆動電圧波形を供給して駆動する方法等についても上述の実施例は表示むらを解消する効果がある。

【０１３７】［実施例２０］表示機能を必要とする電子機器例えばパーソナルコンピュータ，ワードプロセッサー，電子手帳等に実施例１から１９のいずれか表示装置を用いることによって電子機器の表示品質を向上させることが出来る。

【０１３８】

【発明の効果】以上述べたように、液晶表示装置系のある部分の電圧変化あるいは電流変化を検出することによって、液晶パネルの電極上に発生する歪を想定し、これ

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によって補正電圧を発生させて、この補正電圧を駆動電圧波形に付け加えることによって容易に表示むらを改善出来た。即ち、表示データから歪量を計算する回路が不要となって、極めて簡素な回路構成で高品位の表示をする液晶表示装置を提供することが出来、さらにこの表示装置を用いた電子機器の表示部が高品位となり、また小型軽量化を図ることができた。そして、液晶表示装置系のある部分の電圧変化あるいは電流変化を検出することによって、液晶パネルの電極上に発生する歪を想定し、これによって補正電圧を発生させるので、液晶パネルを駆動する駆動方法を問わずに表示むらを改善することが出来るようになった。

【図面の簡単な説明】

【図１】実施例１の液晶表示装置の構成を示す図。

【図２】実施例１の電圧加算回路の具体的な一構成例を示す図。

【図３】実施例１の液晶表示装置を駆動する信号の電圧波形を示す図。

【図４】実施例１の動作を説明する電圧波形を示す図。

【図５】実施例２の液晶表示装置の具体的な一構成例を示す図。

【図６】実施例３の液晶表示装置の具体的な一構成例を示す図。

【図７】実施例４の液晶表示装置の具体的な一構成例を示す図。

【図８】実施例５の液晶表示装置の具体的な一構成例を示す図。

【図９】実施例５の動作を説明する電圧波形を示す図。

【図１０】実施例６の液晶表示装置の具体的な一構成例を示す図。

【図１１】実施例７の液晶表示装置の具体的な一構成例を示す図。

【図１２】実施例７の電圧加算回路の具体的な一構成例を示す図。

【図１３】実施例８の液晶表示装置の具体的な一構成例を示す図。

【図１４】実施例９の液晶表示装置の具体的な一構成例を示す図。

【図１５】実施例１０の液晶パネルの具体的な一構成例を示す図。

【図１６】実施例１１の液晶表示装置の具体的な一構成例を示す図。

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【図１７】実施例１１の可変増幅器の具体的な一構成例を示す図。

【図１８】実施例１２の液晶表示装置の具体的な一構成例を示す図。

【図１９】実施例１２の電圧補正回路の具体的な一構成例を示す図。

【図２０】実施例１３の電圧補正回路の具体的な一構成例を示す図。

【図２１】実施例１４の電圧補正回路の具体的な一構成例を示す図。

【図２２】実施例１４の他の電圧補正回路の具体的な一構成例を示す図。

【図２３】実施例１５の電圧補正回路の具体的な一構成例を示す図。

【図２４】実施例１６の電圧補正回路の具体的な一構成例を示す図。

【符号の説明】

１０は液晶パネル

１０１、１０２は一対の基板

Ｙ１～Ｙ６は走査電極

Ｘ１～Ｘ６は信号電極

１１は信号電極駆動回路（Ｘドライバ）

１１１はシフト・レジスタ回路

１１２はラッチ回路

１１３はアナログ・スイッチ回路

１２は走査電極駆動回路

１２１はシフト・レジスタ回路

１２２はアナログ・スイッチ回路

１３は電源回路

１３１は電圧分割回路

Ｒ１～Ｒ５は抵抗器

ＯＰ１～ＯＰ４はボルテージ・ホロワ回路

１３２は基準電圧切り替えスイッチ

１３３は入力電圧切り替え制御回路

１３４は入力電圧切り替え制御信号

１３５は入力電圧切り替えスイッチ

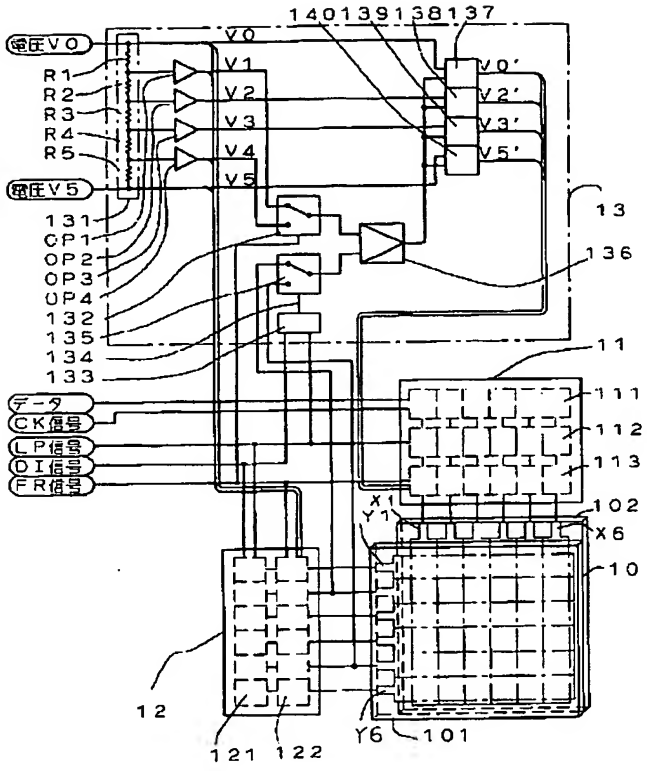
１３６は差動増幅回路

１３７～１４０は電圧加算回路

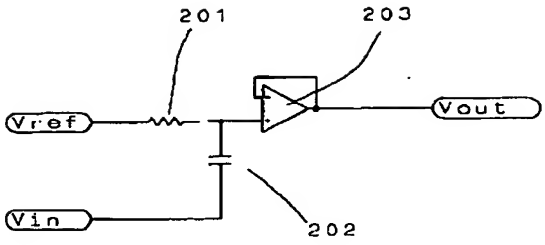
電圧Ｖ０、Ｖ５は外部から供給される電圧

データ信号、ＣＫ信号、ＬＰ信号、ＤＩ信号、ＦＲ信号は液晶表示装置を駆動する信号

【図1】



【図2】



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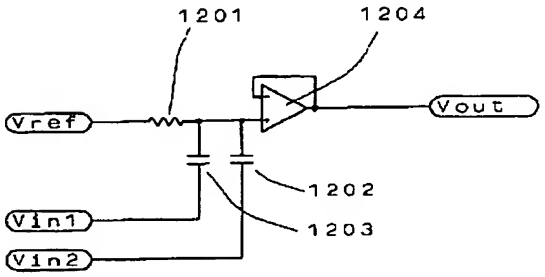

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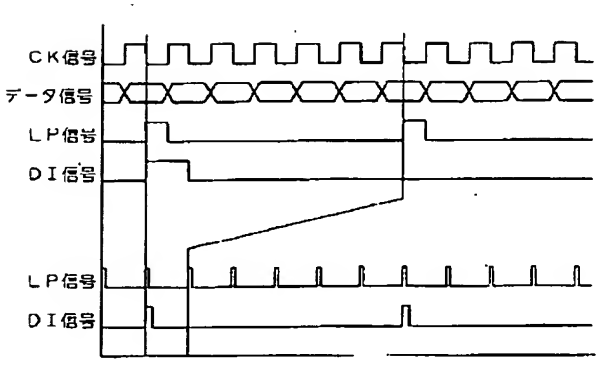

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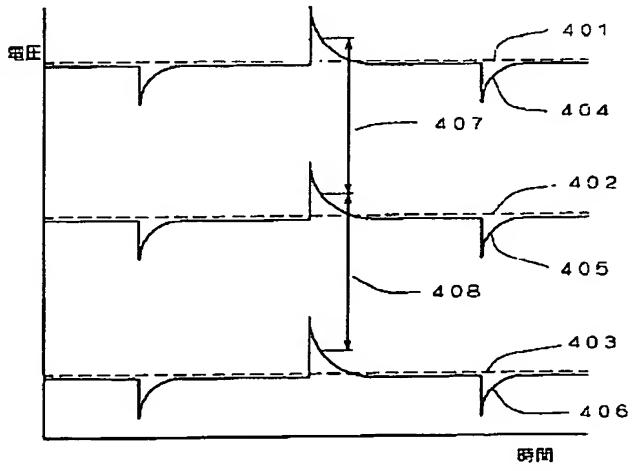

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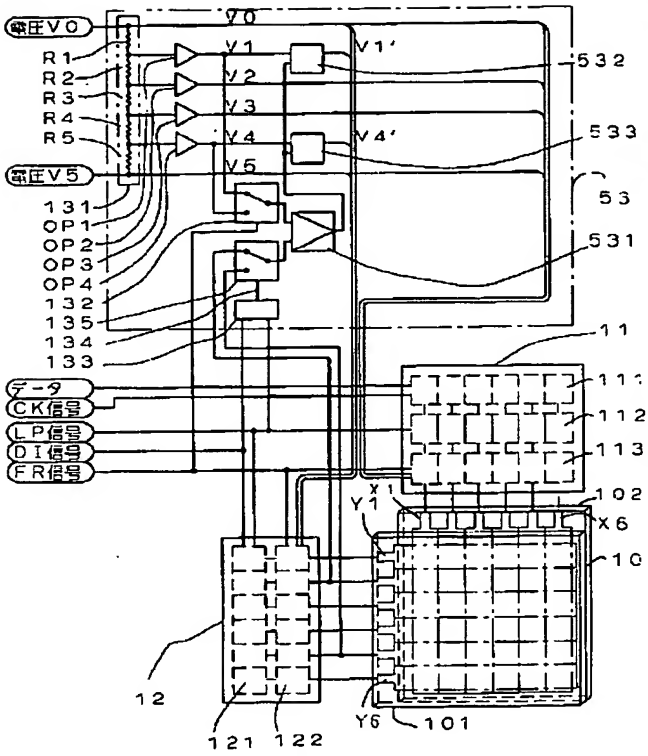
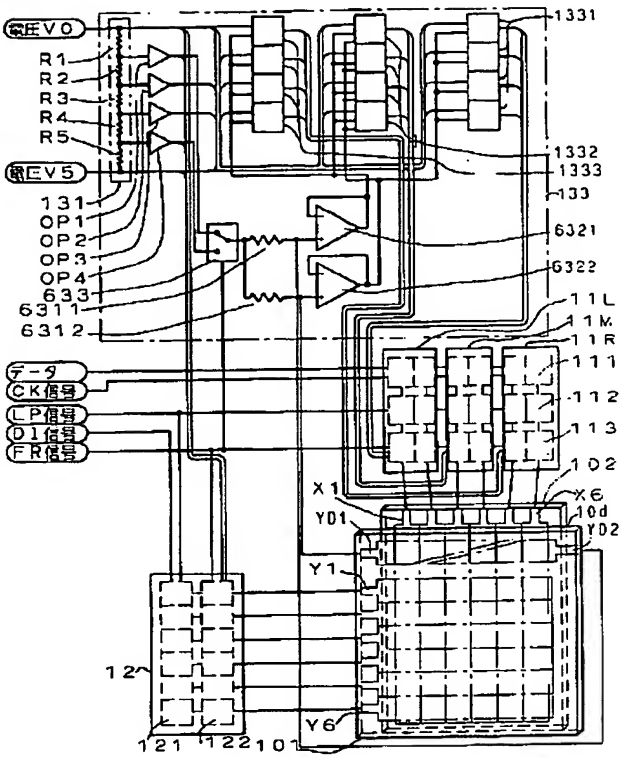
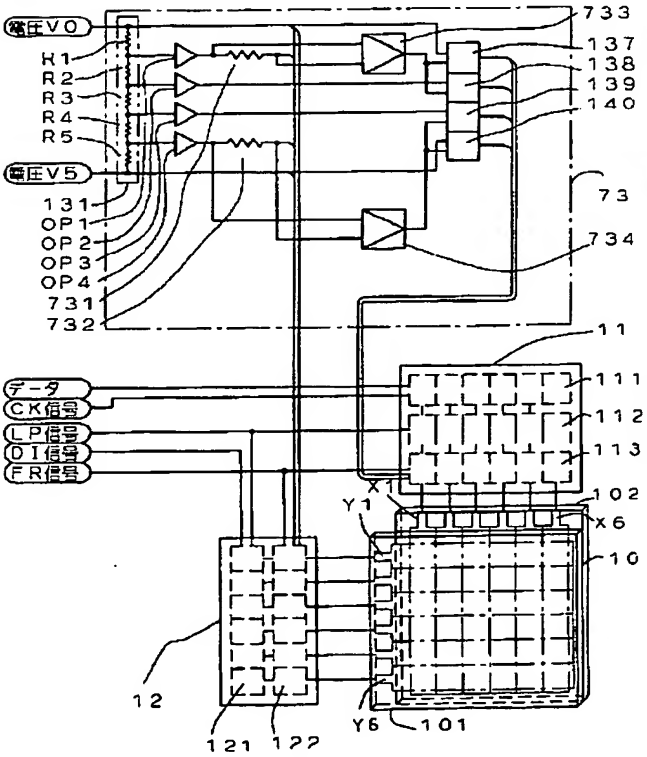

電圧V0
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
132
135
134
133
V0
V1
V2
V3
V4
V5
V1'
V4'
532
533
53
531
11
111
112
113
102
X6
10
データ
CK信号
LP信号
DI信号
FR信号
X1
Y1
Y6
101
12
121
122

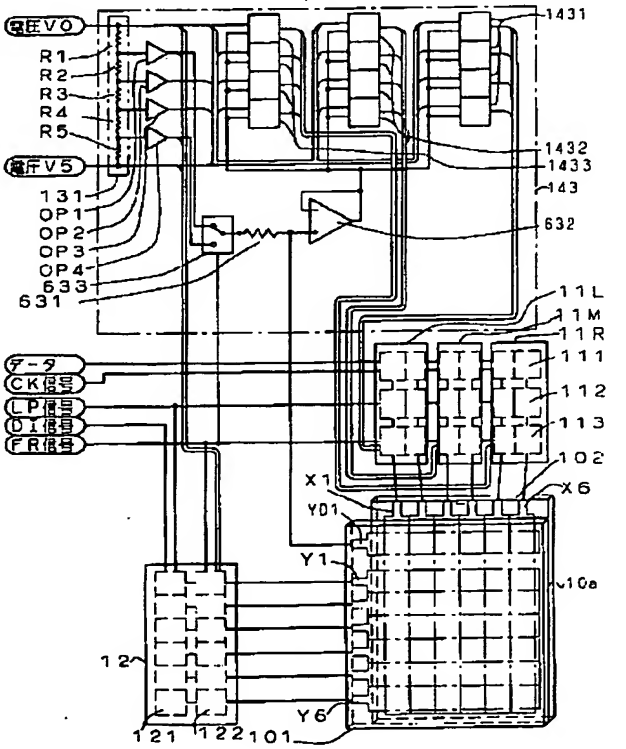
【図13】


電圧V0
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
633
6311
6312
1331
1332
1333
133
6321
6322
11L
11M
11R
111
112
113
102
X6
10d
YD2
データ
CK信号
LP信号
DI信号
FR信号
X1
YD1
Y1
Y6
12
121
122
101

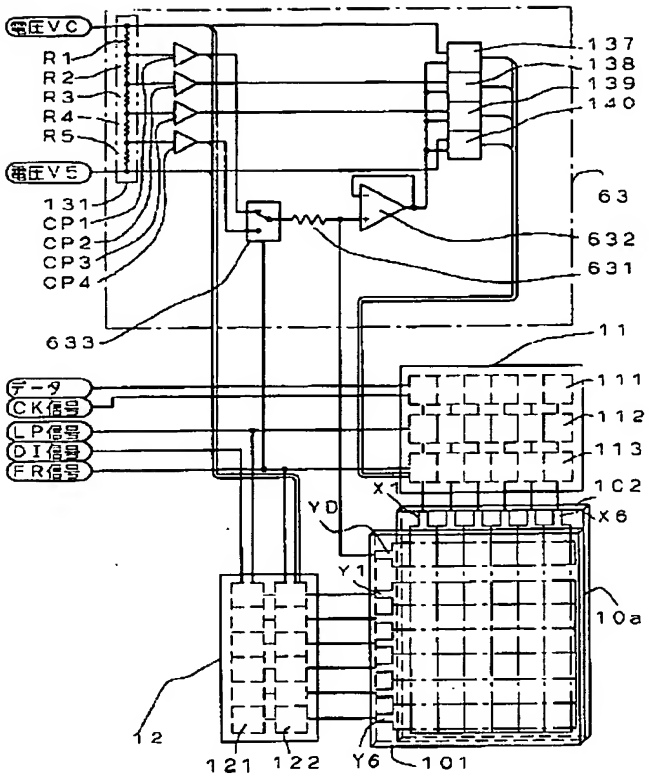
【図7】


電圧V0
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
731
732
733
137
138
139
140
73
734
11
111
112
113
102
X6
10
データ
CK信号
LP信号
DI信号
FR信号
X1
Y1
Y6
101
12
121
122

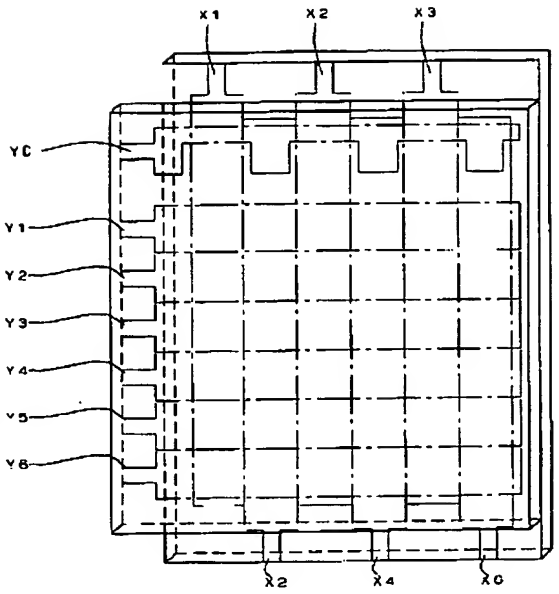
【図14】


電圧V0
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
633
631
1431
1432
1433
143
632
11L
11M
11R
111
112
113
102
X6
10a
データ
CK信号
LP信号
DI信号
FR信号
X1
YD1
Y1
Y6
12
121
122
101

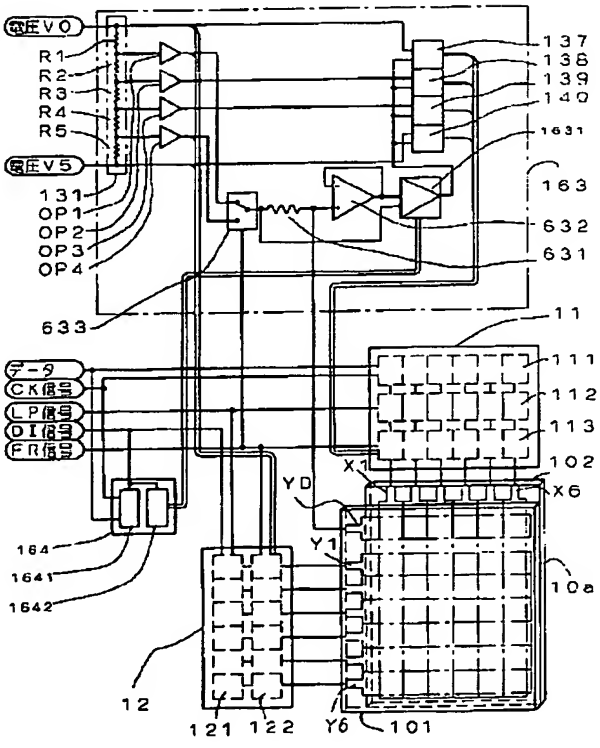
【図６】


電圧VC
R1
R2
R3
R4
R5
電圧V5
131
CP1
CP2
CP3
CP4
633
データ
CK信号
LP信号
DI信号
FR信号
137
138
139
140
63
632
631
11
111
112
113
102
X1
YD
X6
Y1
10a
12
121
122
Y6
101

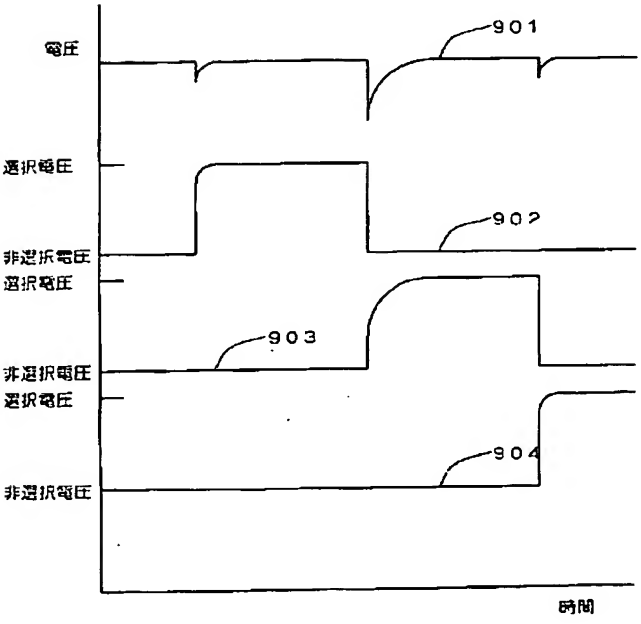
【図１５】


X1
X2
X3
YC
Y1
Y2
Y3
Y4
Y5
Y6
X2
X4
X6

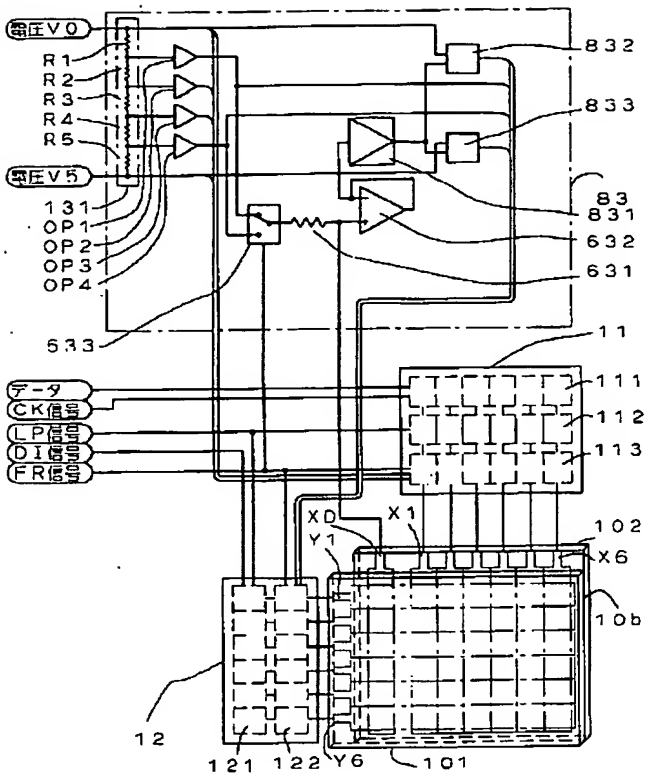
【図１６】


電圧VO
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
633
データ
CK信号
LP信号
DI信号
FR信号
137
138
139
140
1631
163
632
631
11
111
112
113
102
X1
YD
X6
Y1
10a
164
1641
1642
12
121
122
Y6
101

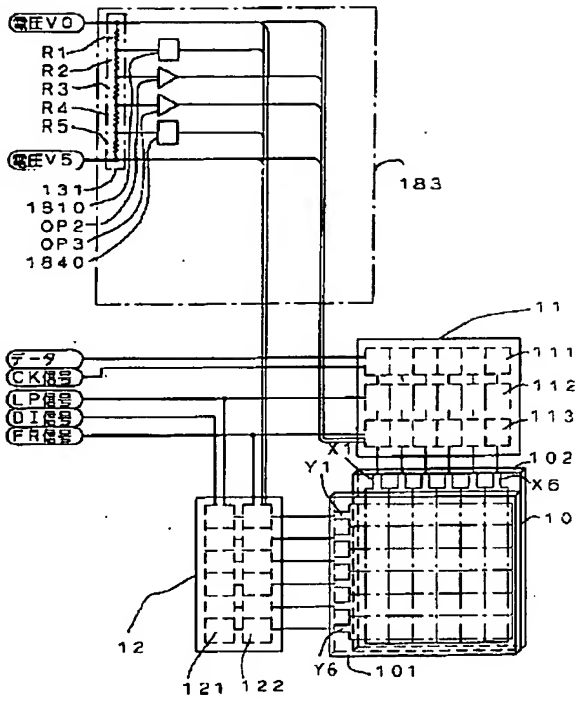
【図９】


電圧
901
選択電圧
非選択電圧
902
選択電圧
903
非選択電圧
選択電圧
904
非選択電圧
時間

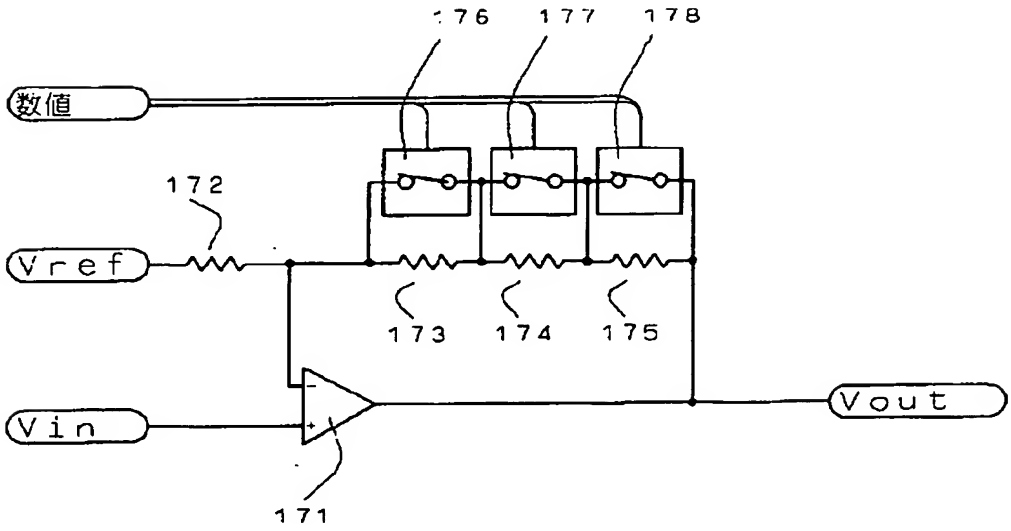
【図8】


電圧V0
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
533
832
833
83
831
632
631
11
111
112
113
データ
CK信号
LP信号
DI信号
FR信号
X0
X1
Y1
102
X6
10b
12
121
122
Y6
101

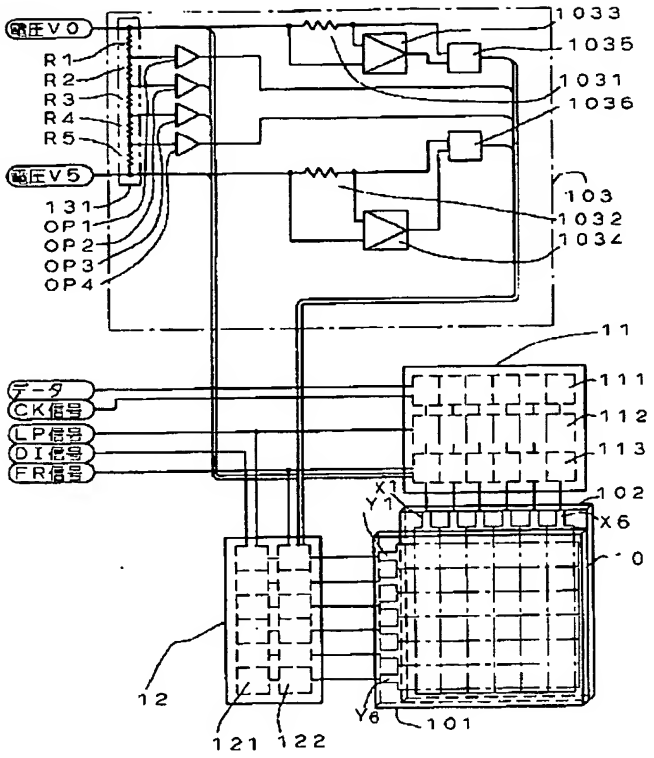
【図18】


電圧V0
R1
R2
R3
R4
R5
電圧V5
131
1810
OP2
OP3
1840
183
11
111
112
113
データ
CK信号
LP信号
DI信号
FR信号
X1
Y1
102
X6
10
12
121
122
Y6
101

【図17】


176
177
178
数値
172
Vref
173
174
175
Vout
Vin
171

【図１０】



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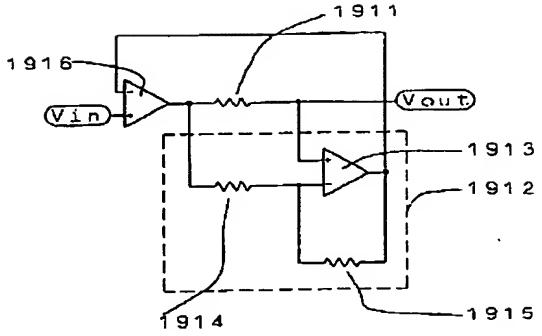

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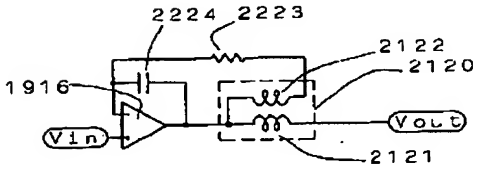
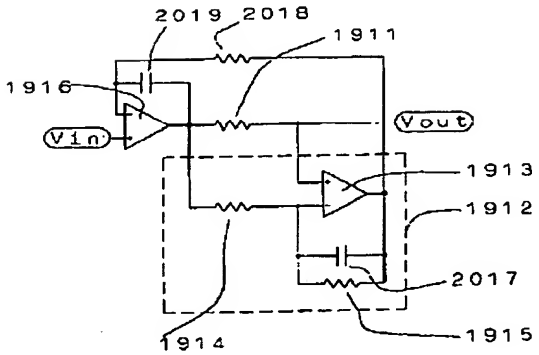


【図２０】



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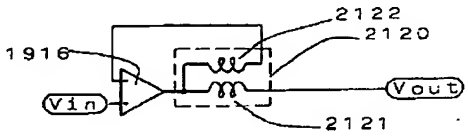

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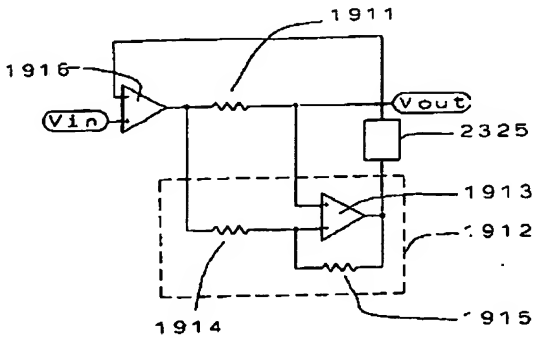
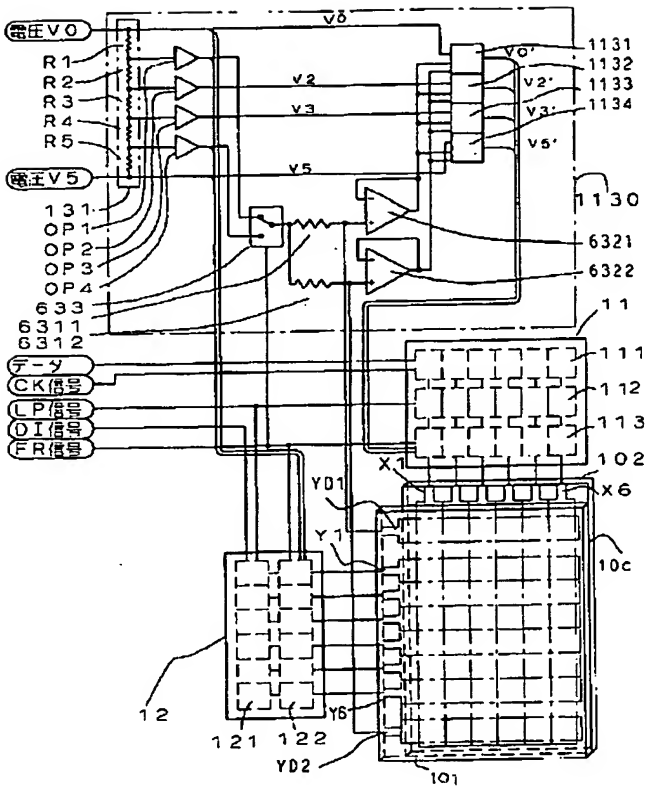


【図１１】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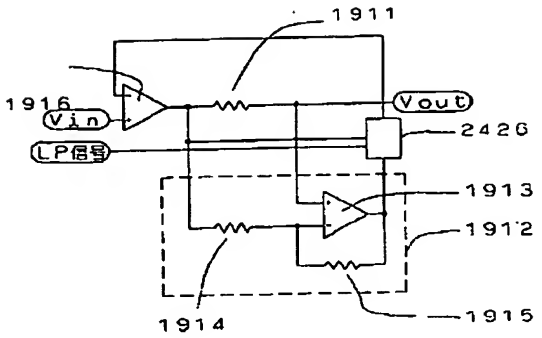
R1
R2
R3
R4
R5
電圧V5
131
OP1
OP2
OP3
OP4
633
6311
6312
データ
CK信号
LP信号
DI信号
FR信号
V0
V2
V3
V5
V0'
V2'
V3'
V5'
1131
1132
1133
1134
1130
6321
6322
11
111
112
113
102
X1
X6
YD1
Y1
10c
12
121
122
Y6
YD2
101

【図２４】


1911
1916
Vin
LP信号
Vout
2426
1913
1912
1914
1915